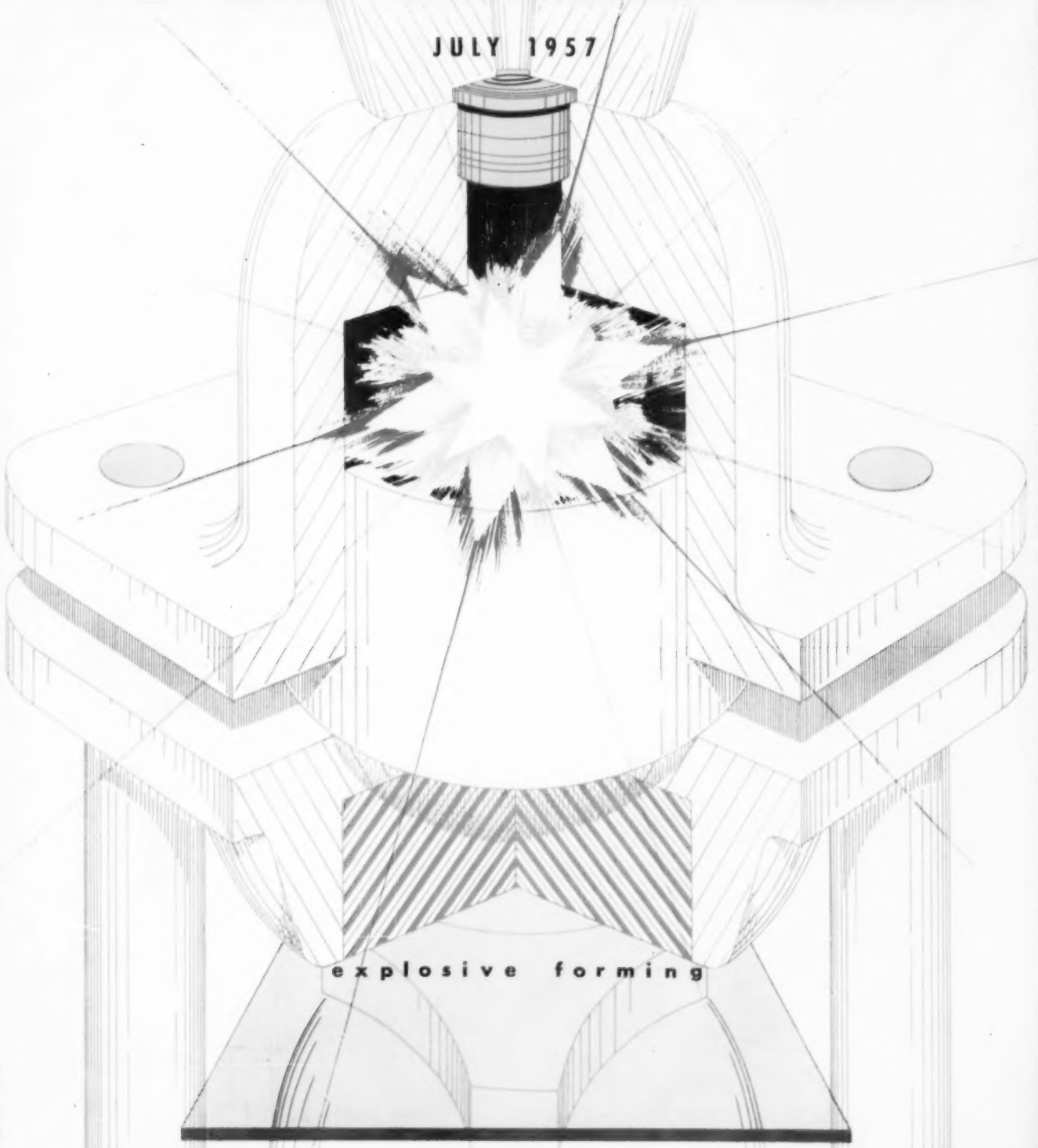
THE

TOOL ENGINEER

JULY 1957



explosive forming

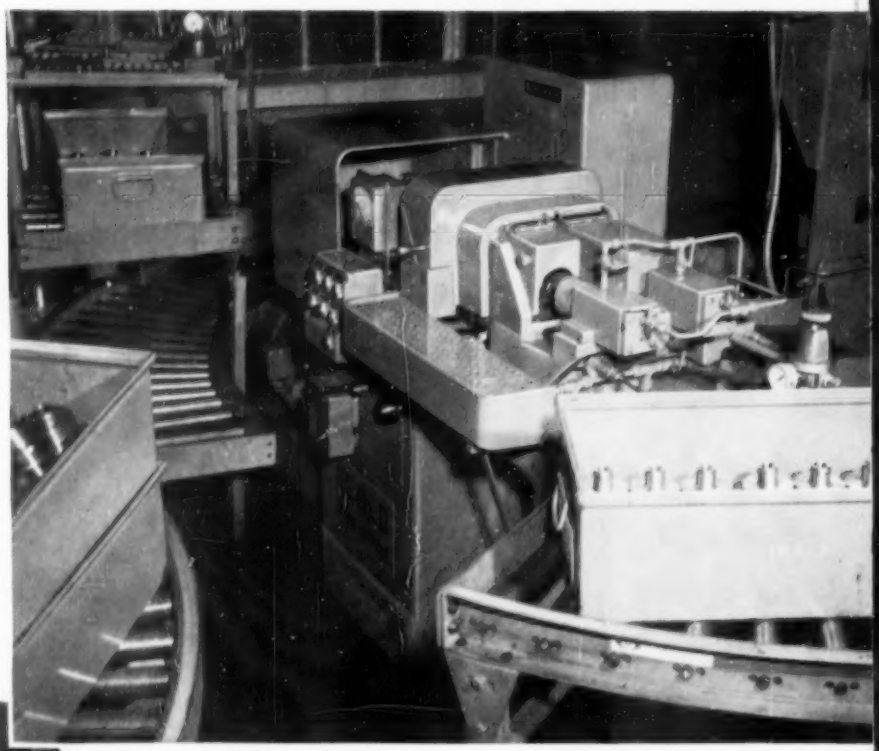
PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

GUN DRILLING on a Bore-Matic gives

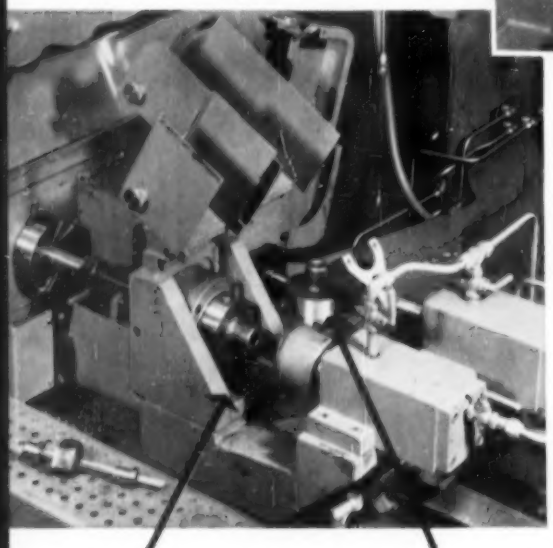
SURE-FIRE PRODUCTION

with

- higher precision
- better finish
- easier operation
- less maintenance
- lower costs



Model 121 Bore-Matic equipped for gun drilling is positioned in a conveyorized production line. Left foreground conveyor brings work to operator and lower background conveyor takes it to intermediate operations. Right foreground conveyor returns work for second gun drilling and upper background conveyor takes pieces away.



FRONT STATION—Gun drill plunger hole from solid. Coolant is confined inside part, after drill breaks through, by Neoprene tip on hydraulic clamping head.

REAR STATION—Gun drill port hole from solid. Holes are plugged to confine pressure (750 psi) coolant inside work after drill breaks through.

THE PRECISION and speed of a Bore-Matic make it a natural for gun drilling. For example, the two-station Model 121 shown here was fitted with adapters to hold the gun drills on the boringhead spindles and with hydraulic clamping heads mounted on the table for the mating bushings. It replaced a two-spindle gun drilling machine for handling the plunger and port holes in Nitralloy hydraulic heads. Here are the results:

PRODUCTION was increased from 24 to 27 parts per hour for plunger hole. Port hole production — previously done on drill press with final location by subsequent grinding of shoulder — went up to 48 parts per hour with *accurate* location.

TOLERANCES were reduced from .002 to .001. Both holes straight within 20 to 30 millionths.

FINISH was improved from 60 rms to 15 rms; and honing was eliminated.

OPERATIONAL handling time was cut in half.

MAINTENANCE was substantially reduced.

COSTS were cut by 75% over previous method.

Another plus factor was that the closer tolerances resulted in great savings in subsequent operations.

For more information on this and other interesting and profitable set-up possibilities with a Bore-Matic, get in touch with your nearest Heald representative.

IT PAYS TO COME TO HEALD!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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HEALD®

COVER: The sharp explosion of this 12-gage shotgun shell slams the rubber head onto the work sheet, wraps the sheet around the form block and heralds the approach of a new method of forming. Details of this new process are given in the article starting on page 83.

The Tool Engineer

Volume XXXIX, No. 1 July 1957

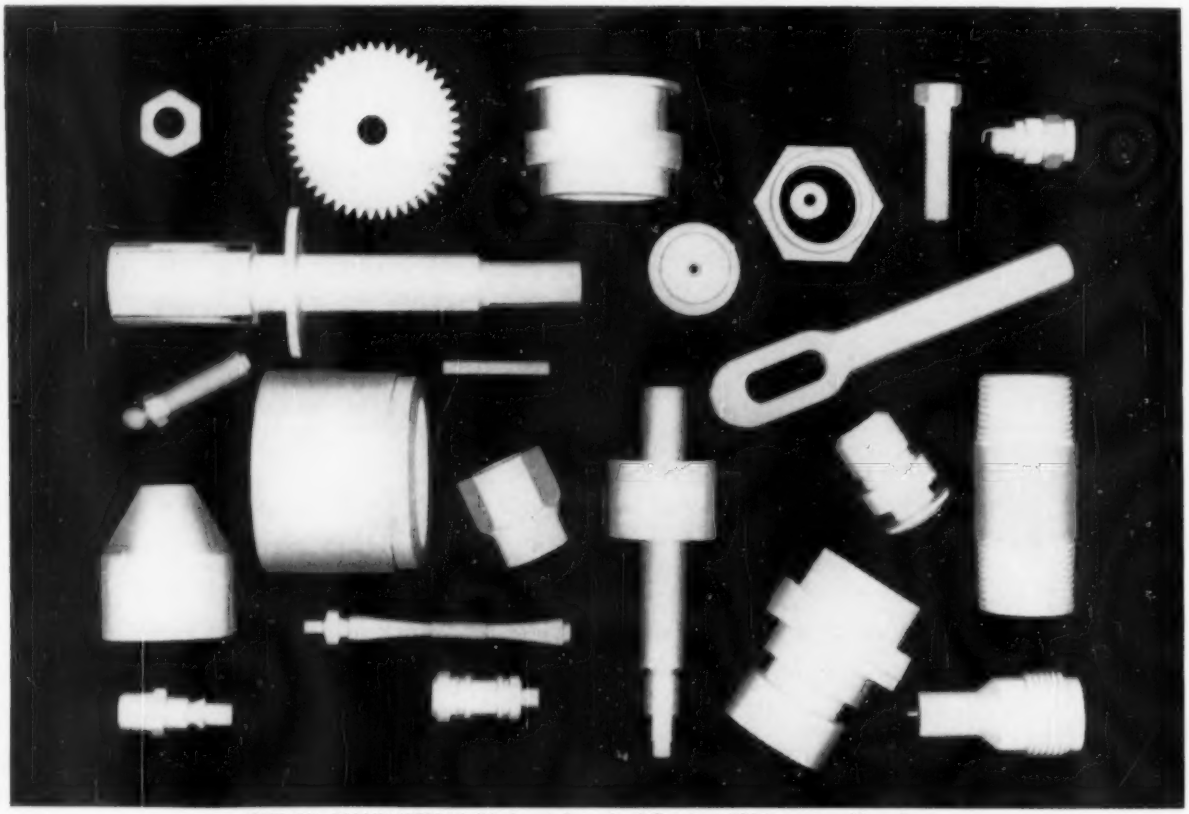
TECHNICAL ARTICLES

ASTE NEWS

DEPARTMENTS

PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and the *Industrial Arts Index*



ONE OIL, MANY METALS. Moderately priced Sunicut 5534 gave uniformly excellent results in the machining of this wide variety of top-quality steel parts.

Designed especially for job shops...

NEW SUNICUT 5534 CAN BE USED ON A WIDE VARIETY OF STEELS

SUNICUT® 5534 ends your search for a single cutting oil that can assure quality machining of a wide variety of ferrous metals...ranging from B1112 to 4130 and including free-machining stainless steels.

A non-emulsifying, transparent cutting oil, Sunicut 5534 can speed production of general screw machine and turret lathe work. It gives excellent finish in tapping, drilling, threading, and light stamping operations and can be used on many special jobs run at both high and low speeds.

Try moderately-priced Sunicut 5534. It can save you money by reducing your cutting oil inventories and oil change time. It can boost your production and profits.

For detailed information, prices and delivery data about this new, versatile cutting oil, call your Sun representative today. Or write directly to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. TE-7.

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INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY Philadelphia 3, Pa.

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The Bigger Job

In making decisions that eventually result in more products of higher quality at less cost, tool engineers can change the entire structure of a company. With one set of specifications, a tool engineer can obsolete production equipment, plant layouts or plant buildings themselves. He should be able to interpret the results of his actions in terms of changes that will occur throughout the company.

Even where changes are not drastic, influences on other departments can be profound. By increasing the number and scope of automatic operations, for example, the tool engineer introduces problems of relocation of operating personnel, upgrading and training of maintenance personnel, pay structure changes and organizational changes.

The finance department may have to obtain new capital. Design engineers' freedom may be lessened by having to design within the limits imposed by unamortized, expensive production equipment. Purchasing policies may be handicapped because fewer sources of supply are available. New departments may be required and new lines of authority may have to be established. Production may increase to such an extent that all sales polices will have to be revamped.

It is not sufficient to evaluate tool engineering projects in terms of immediate or present over-all effects. A tool engineer should also think in terms of long-range planning to insure the future growth of his company. If he is aware of the problems created by his actions and is also prepared to provide data to help top management make decisions necessitated by these actions, his will be the bigger job.

Robert A. Wason

ASSOCIATE EDITOR

...for piloted taps from stock

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CUTTING TOOLS AND GAGES

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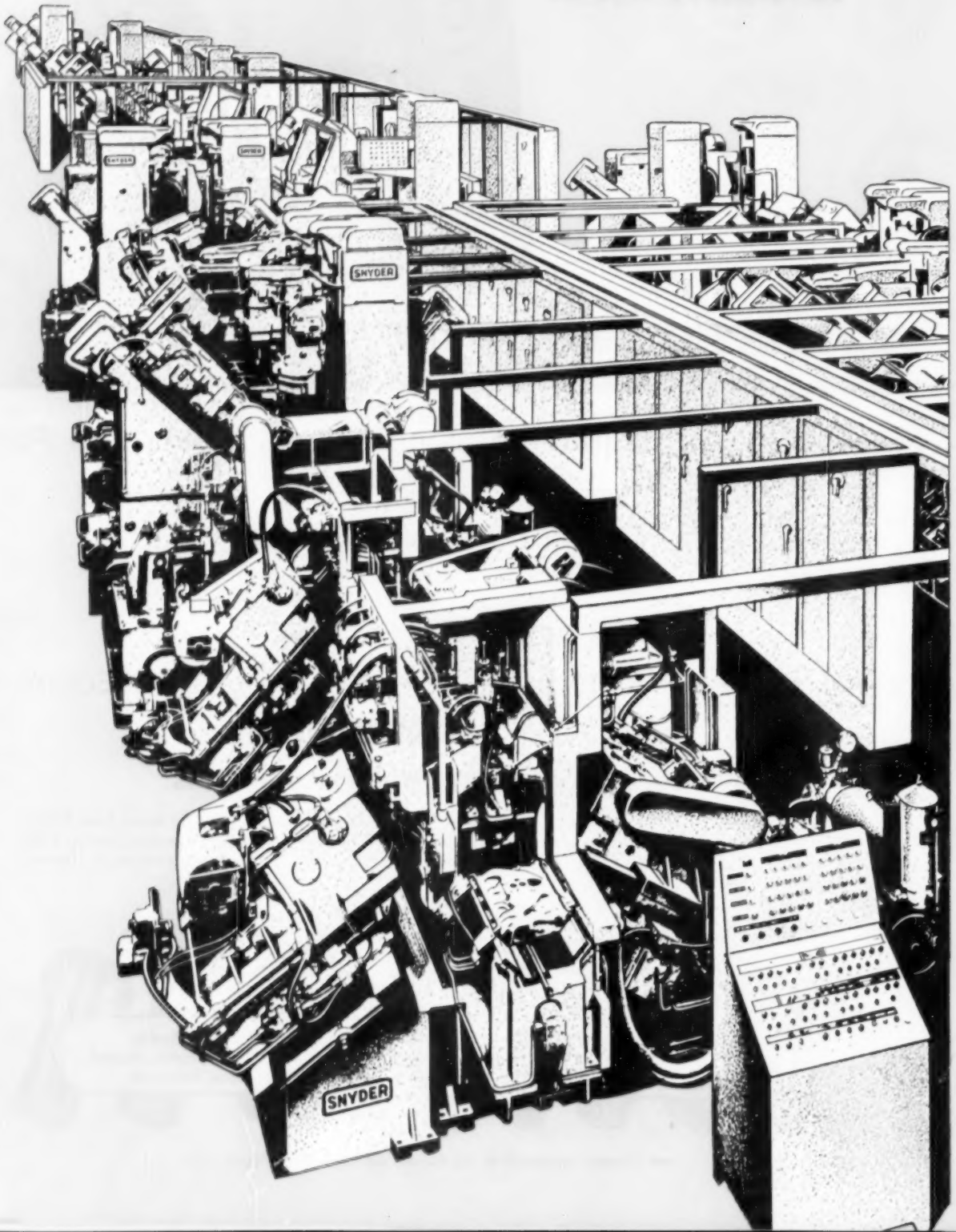
Unique Combination of Snyder Special Two or Four Barrel Intake Manifold

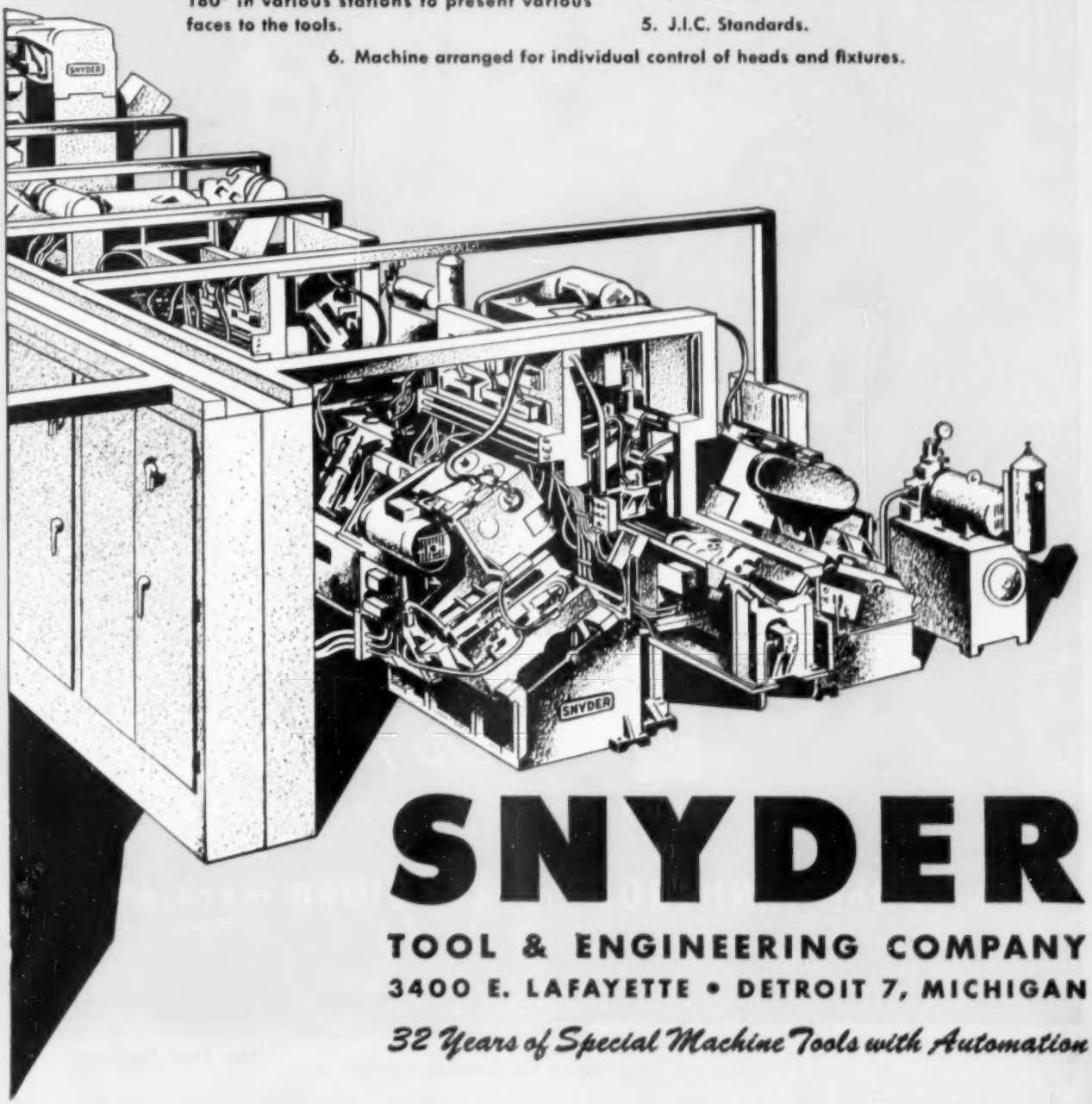


Transfer Machines Processes Either Castings from Rough to Finished Parts

Combination of two special transfer milling machines in parallel, with automation, feeding into one special transfer drilling machine gives production of 136 pieces per hour

Special Features of Snyder Machines Nos. 55-60 and 55-61

1. Machine line handles two or four barrel manifolds, random intermixed; sensing devices automatically instruct the proper drilling and tapping units.
2. Part rotated vertically 180° and horizontally 180° in various stations to present various faces to the tools.
3. Individual electrical panels and hydraulic units for each segment.
4. Wing bases, sections, spacers and risers standard throughout for easy adaptation to future part changes.
5. J.I.C. Standards.
6. Machine arranged for individual control of heads and fixtures.



SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

32 Years of Special Machine Tools with Automation

Fig. 1

4 feet of thread *per minute*

with the LANHYROL thread rolling machine

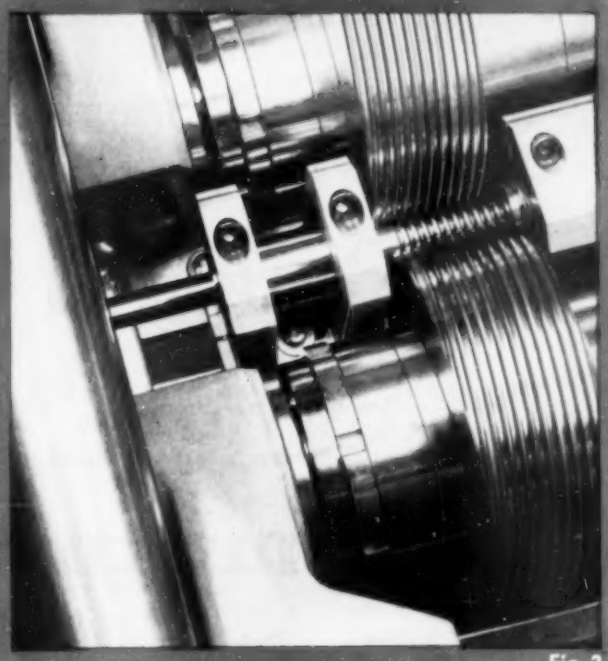


Fig. 2

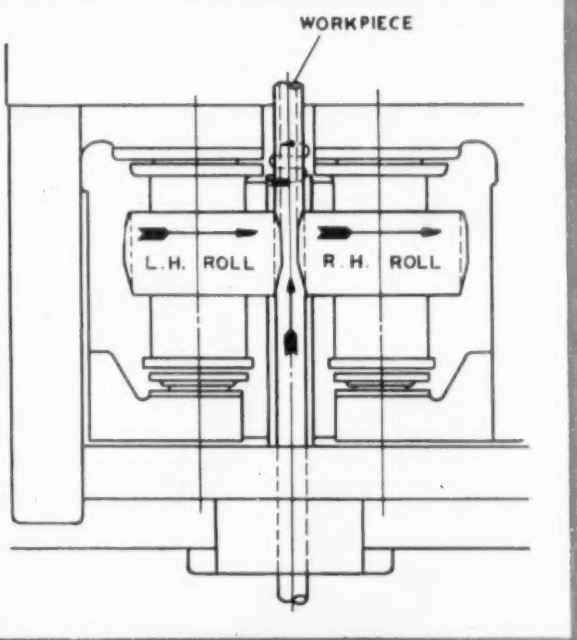


Fig. 3

The LANHYROL Thread Rolling Machine has shown outstanding results in output and thread quality producing ¾" jack screws at the M & S Manufacturing Company in Hudson, Michigan.

20-foot bar lengths of C1117 steel are being formed by Thrufeed Rolling at the rate of 48 linear inches per minute. The ¾"—6 pitch left-hand Acme threads are held within .001" on the pitch diameter throughout the entire bar length. Over 59,000 feet of thread have been produced with a set of roll dies.

Thrufeed Rolling is designed for workpieces requiring threads on the maximum diameter only or for headed parts with over 5⅞" of thread length. In this application, the workpiece is placed in a feeding tube which is halved for loading convenience (Figure 1). It is then passed axially into ball-bearing work supports and between the rolls (Figure 2). Rolls with a throat section for progressive generation of the thread provide a self-leading action as the threads are formed (Figure 3). Operation is continuous, with rolls revolving at correct fixed center distance. The right-hand roll unit may be retracted at anytime for set-up adjustment or stock removal.

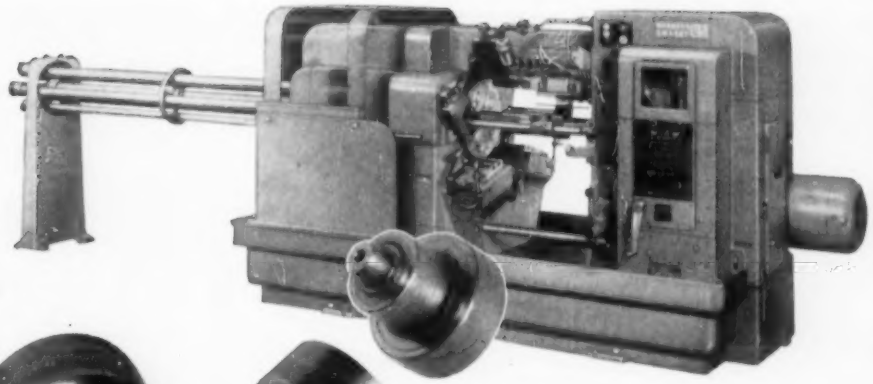
The LANHYROL Machine also produces quality threads at high rates of output by the Infeed and Continuous rolling methods. Its range and flexibility is so great that we recommend your consideration of this equipment for any job requiring precision threads of excellent finish at high production rates. Please send specifications and ask for Bulletin E-60.

LANDIS *Machine* COMPANY
WAYNESBORO · PENNSYLVANIA

Warner & Swasey's cost-cutting Automatics boost production for Thor Power Tool Company

Look at these typical time and cost savings delivered by Warner & Swasey 5-Spindle Automatic Bar Machines at Thor Power Tool's Aurora, Illinois plant.

YOU CAN PRODUCE IT



AUTOMATIC BAR MACHINES
1¼" Bar Capacity
1¾" Standard Capacity
2¼" Oversize Capacity

AUTOMATIC CHUCKING MACHINE
6" Swing

Reduction Gear Blanks

Savings pay for several new machines!

Large variety required—in lot sizes of 150-1500 pieces. Material — 8460 Steel.

Previous method — 2 single-spindle automatics, running continuously.

NOW — One Warner & Swasey 5-Spindle Automatic does complete machining in equivalent of 4 days a week.

Lock Collar

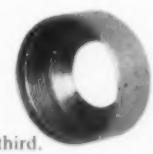
Slashes machining time on longer runs!

Quantities — 20,000 - 30,000 pieces.

Previous method — Run on conventional multi-spindle automatics in 75 seconds.

NOW — on Warner & Swasey 5-Spindle Automatics parts made in 27 seconds!

Thin Walled Protection Nut

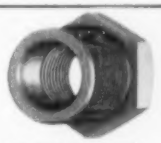


Combines operations at high removal rate!

Previous method — Three operations — rough turned, relief cut made in second operation, Class 3 threads hobbed in third. Cost of last step alone ran 20 cents per part.

NOW — finished in one operation in 132 seconds on Warner & Swasey 5-Spindle Automatic.

Reducer Bushing



Cuts Class 4 threads in same operation — costs reduced 8.5 to 1!

Previous method — Threads milled, following rough forming on single-spindle automatic.

NOW — Complete machining finished on Warner & Swasey 5-Spindle Automatic in one operation in 27 seconds!

Sanding Pad Nut

One machine does work spread over 3 departments!

Problem — To thread part at perfect 90° angle to outside face, and hold concentricity.

Previous method — Part machined in 3 different departments. Difficulty was experienced in holding piece in fixture for knurling.

NOW — Thread tapped into bar stock and balance of cuts made, including knurling, in one operation on Warner & Swasey 5-Spindle Automatic.

Drive Shaft Impact Spindles

Accuracy and rigidity deliver 4 to 1 savings!

Material — Super tough rivet set alloy, especially made for Thor.

Previous method — Roughed on single-spindle automatic, straddled to length on turret lathe — both machines running at half speed.

NOW — finished for grinding in single operation on Warner & Swasey 5-Spindle Automatic running at full speed.

BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

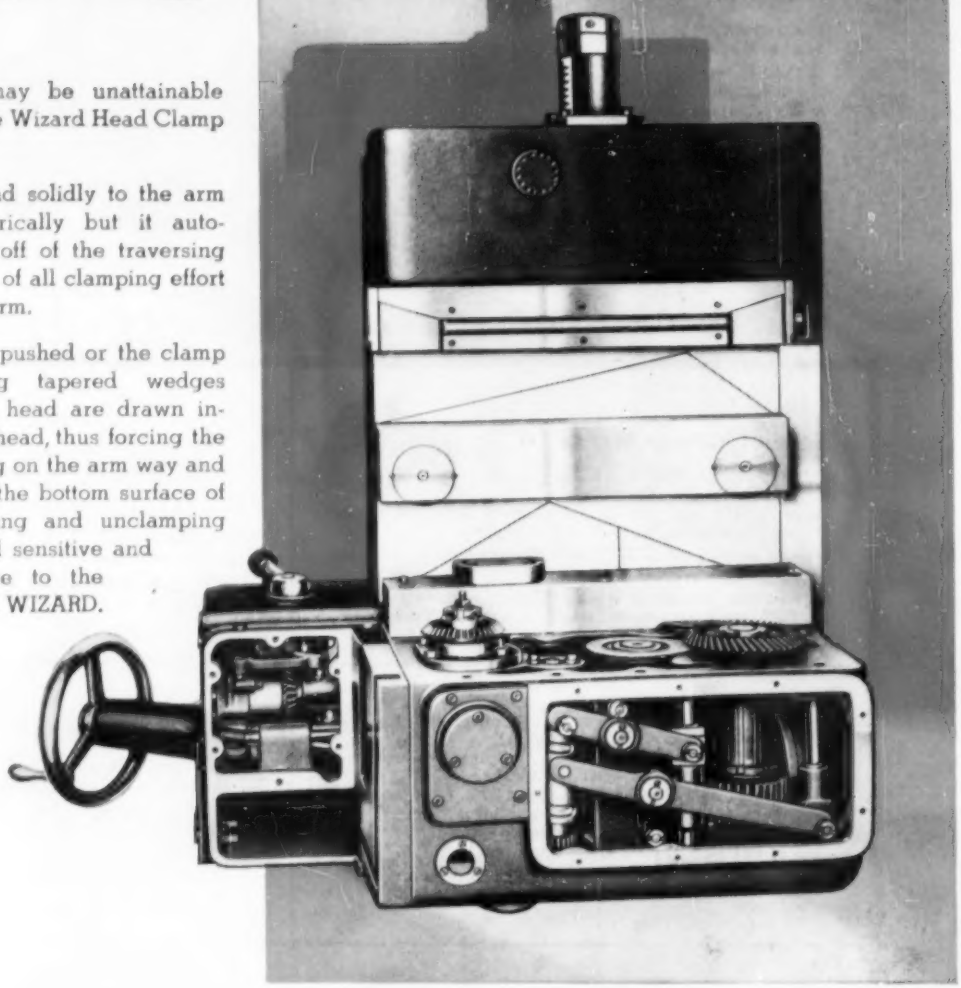
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

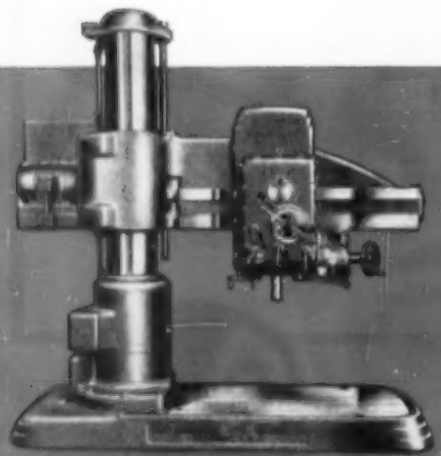
Clamping Perfection

Theoretically perfection may be unattainable but practically the new Hole Wizard Head Clamp is perfect.

It not only clamps the head solidly to the arm either manually or electrically but it automatically raises the head off of the traversing rollers, thus relieving them of all clamping effort and binds it solidly to the arm.

When the clamp button is pushed or the clamp lever actuated, opposing tapered wedges between the arm and the head are drawn inwardly at each side of the head, thus forcing the head off of its roller bearing on the arm way and wedging it solidly against the bottom surface of of the arm. This clamping and unclamping action is instantaneous and sensitive and adds another plus feature to the "AMERICAN" NEW HOLE WIZARD.





Plus features

Speaking of Plus Features here are a few you will want in your next radial.

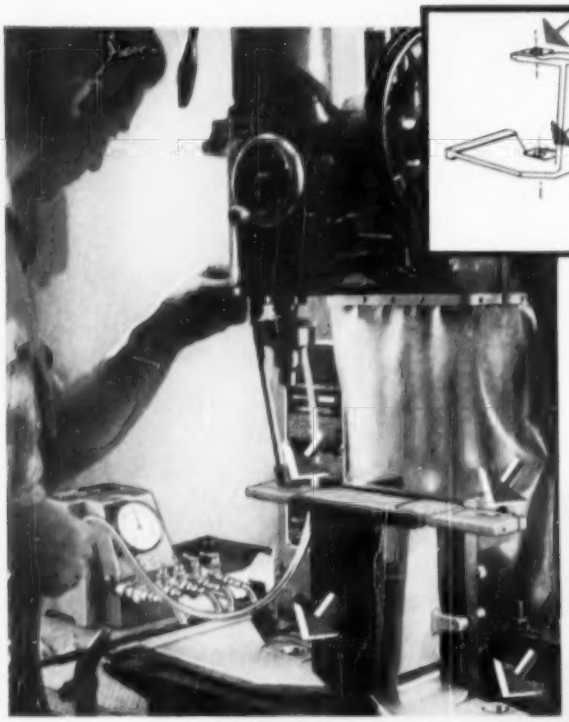
- Centralized Control.
- Lightning-fast Direct Reading Speed Change.
- Nitrided Spindle and Sleeve—practically wear proof.
- Timken mounted column unit defies deflection.
- Raybestos covered, spring steel tapping attachment friction bands, quick acting, wear proof, permitting 40% speed-up for spindle reverse.

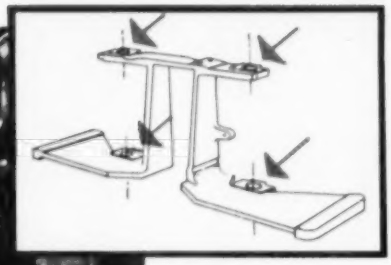
These are just a few . . .
learn the others from bulletin No. 328

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

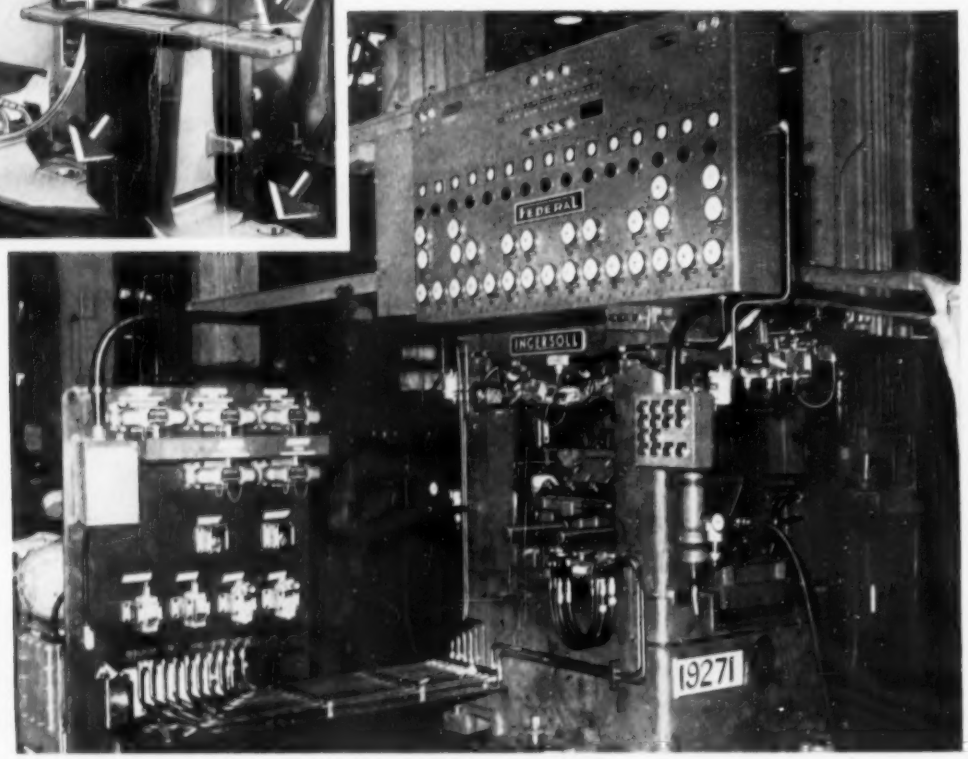
LATHES AND RADIAL DRILLS

THEY GAGE THESE





This application at the Arrow Tool Company, Inc., illustrates the adaptability of the Dimensionair. Here it is equipped with a 5-way manifold to which different gaging units are attached ready for other jobs. On this job a Model A-1250 Adjustable Bore Gage is used to inspect 4 holes. Note that with this particular gage the handle does not have to line up with the hole. Many other jobs, having tolerances from .0004" to 50 millionths, are inspected by this Dimensionair.



Federal air-electric gaging and classifying equipment was used in this gaging station on an engine block transfer line. Two diameters in each of five crankshaft bores and two each in five camshaft bores are measured – twenty holes in all. After automatic assembly, oil holes in the five bearing liners are checked for alignment with the holes in the camshaft bores. All conditions are checked simultaneously. Signal lights indicate all dimensional conditions. Unsatisfactory blocks are automatically rejected. Cycle time is well within production cycle time. Ingersoll Milling Machine Company supplied the handling and positioning units.

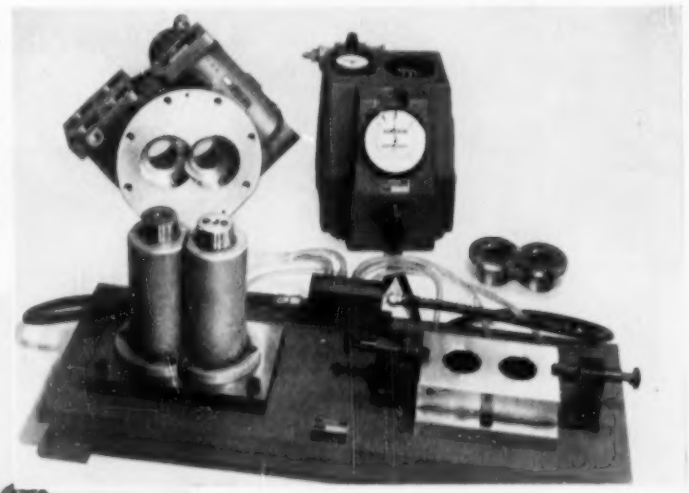
JOBS BETTER

with the DIMENSIONAIR

The increased complexity of more and more of today's gaging requirements calls for the utmost in dependable accuracy. So many times the accuracy of one dimension is dependent upon the accuracy of another. Automation, too, brings in another set of complications where misbehavior of the gaging process can upset your whole schedule.

The dependable no-drift accuracy of the Dimensionair is of the utmost advantage in such cases. Its reliability keeps quality up and keeps production rolling. Even on the simpler jobs the dependable no-drift accuracy and the foolproof operation of the Dimensionair are definitely appreciated. Call on us if you want to do a better gaging job. See our address below.

Two differential type Dimensionairs are used on this precision assembly. The first step is shown at right. Parallel bores in a gear-type fuel pump housing are located on the twin gaging plugs and the bushings that are to be pressed into these bores are placed in the twin ring gage at the right. The Dimensionair shows whether the flange flats on the bushings will have the proper clearance when bushings are assembled in the housing.



A second gage is used for the next step. After the bushings are inserted in the housing, they are located on the left hand pair of gage plugs. Then, a different set of bushings for the cover plate is placed on the right hand plugs. The single dial on this gage shows whether the center distances in the two pairs of bushings are the same within a tolerance of ±.0005". If the first two cover plate bushings measured do not meet this standard, others can be tried until a pair is found that does. Proper alignment of these bearing surfaces is assured at final assembly.

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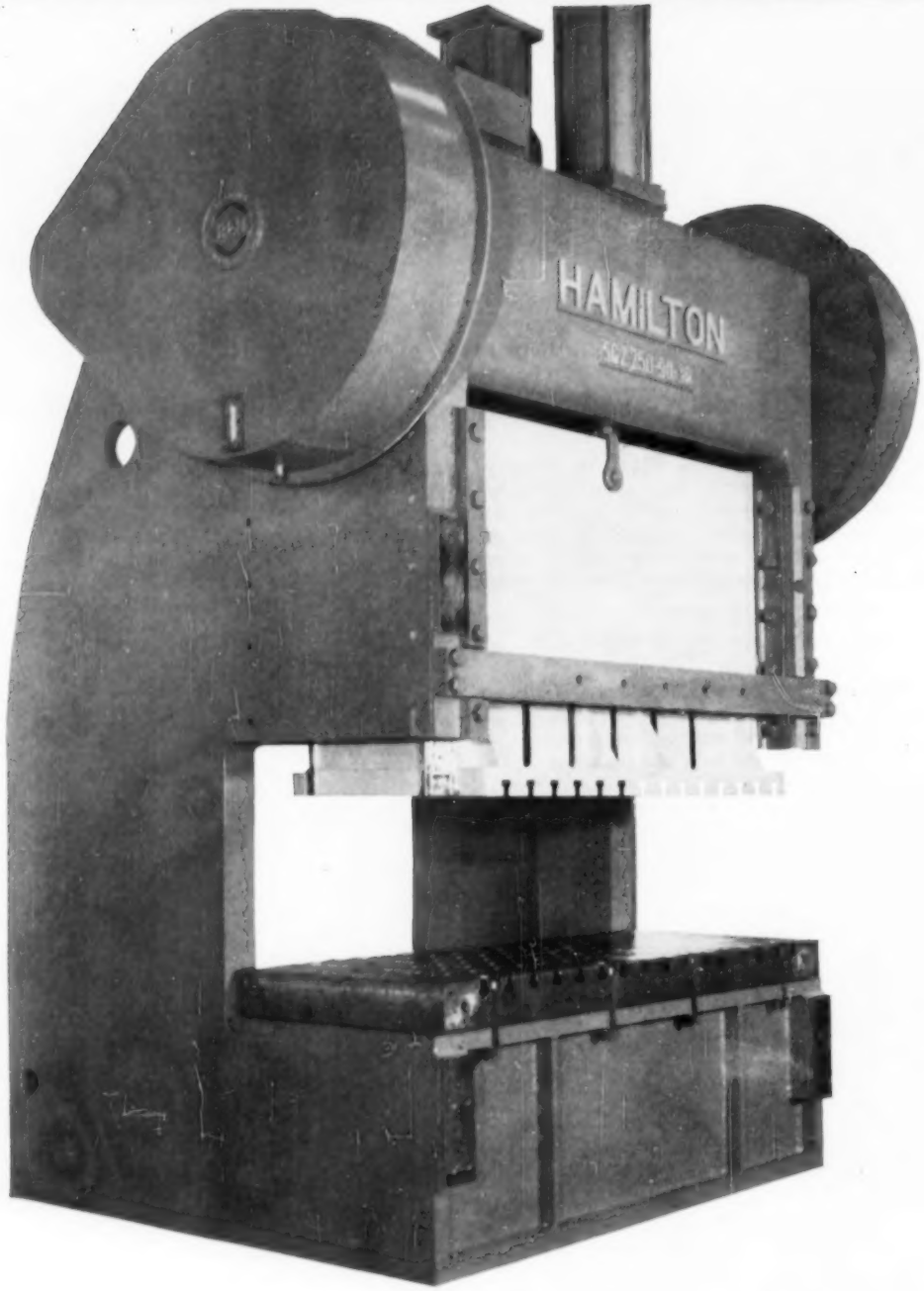
Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



Hamilton press line expanded to include medium size presses

Pictured above is a new Hamilton Gap Press recently installed at the Eaton Manufacturing Company, Cleveland, Ohio. This new large-bed press stamps out the larger grille guards which the latest model cars are calling for.

The capacity of this press is 250 tons and the speed 28 to 30 strokes per minute. Bed area is 90 in. right to left; 36 in. front to back. It is one of a new line of single and double-crank presses ranging from 100-300 tons capacity.

Write to Hamilton Division, B-L-H Corporation, for full information and specifications on this new line of heavy duty Hamilton presses.

Hamilton Division Hamilton, Ohio

BALDWIN · LIMA · HAMILTON

Diesel engines • Mechanical presses • Can making machinery • Machine tools

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

NEW HIGH-SPEED AUTOMATIC THREADING ATTACHMENT SAVES TIME

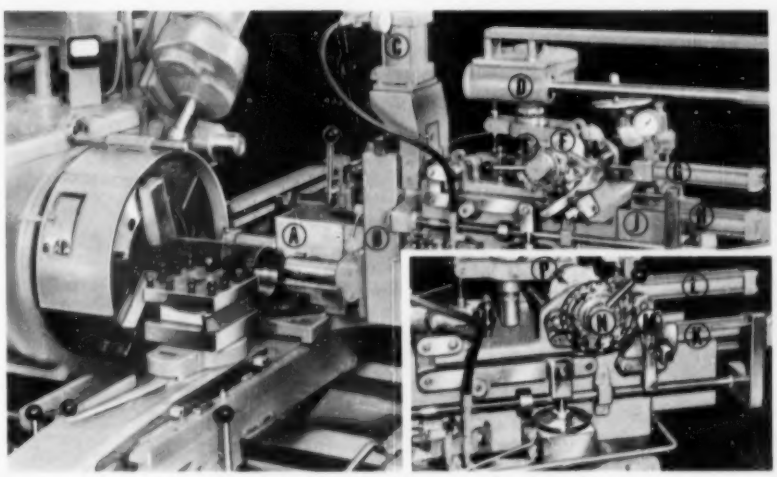
Handles full range of sizes on "Extremeline" oil well casing pipes with minimum change-over

After you've studied this setup, you'll see why it's termed a "cost-cutter" for manufacturers of oil well drill pipe and casings. With it, both I.D. and O.D. threading operations are held to high accuracy—using an automatic repeating thread-chasing slide attachment, mounted on the hexagon turret of a 4L Saddle Type Turret Lathe.

Here's the operation for box ends of "Extremeline" casings, in 8 sizes from 5" to 9⅝" O.D.: Each casing is loaded through the spindle and held by 2 power chucks at the front and rear. Hex turret tools clean up the straight bore, chamfer the I.D. and shave-face the end, while front square turret tools chamfer the O.D. and face to length.

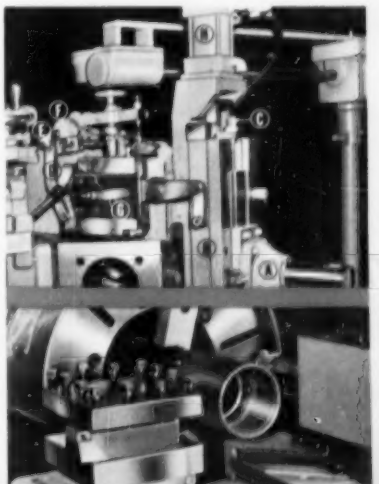
In 2 passes, a JETracer on the rear of the bridge-type cross-slide rough- and finish-contour bores the I.D., indexing a finishing tool on the boring bar into position for the second pass. Using a dial indicator, the hexagon turret carriage is located longitudinally and clamped to the bedways for the threading operation. With gearing off the feed drive shaft driving the threading slide—and change gears providing correct feed for different pitch threads on various part sizes—several fast, automatic passes from the thread-chasing slide attachment complete the part.

For the 7⅜" part shown, f.i.f. time is 10 min. Simple, fast-moving lightweight slide carries threading tool, saves time on repeat passes. Setup eliminates cost of automatic die-heads, upkeep and replacement of expensive chasers.



▲ Tooling setup for machining box end of 7¾" "Extremeline" casing. Here's a typical threading cycle. Clutch D engages; horizontal slide J moves forward carrying vertical slide B and chasing tool A into work. At end of stroke, clutch D disengages and air cylinder H returns slide J. Cylinder C provides follow-up on vertical slide B, eliminates backlash, forces slide to drop at end of pass, relieving tool. On return of slide, stop screw K hits trigger M (inset) releasing escapement wheel N, permitting cam P to be rotated by cylinder L, increasing depth of cut. As full form of thread is engaged, cuts are more shallow. This is governed by decreasing distance between teeth 1, 2, 3, 4, etc., until finished depth is reached. Last 3 passes taken at same depth to clean up cut and compensate for spring in tooling or thin wall of casing.

Change-over for various sizes and I.D. or O.D. threading operations is fast, simple. Flanged tool holder A is set anywhere along T-slots of vertical slide B for various diameters. Micrometer screw C provides final size adjustment. Cam plate G governs path of threading tool for straight or tapered threads in bore on the box end of casings. For external threading on the mating pin ends, cam plate G is reversed, cutter is moved under bar, tool holder A is raised, link D is moved from stud E to F and cylinder H connections are reversed, pulling threading tool up for relief at end of cut.



Finished threads in box end of "Extremeline" casing. Note JETracer tool behind work, not interfering with threading or normal machining operations. Threading slide tool meets "Extremeline" casing thread tolerances with ease, both in lead and thread form.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

HOW TO SIMPLIFY JOB-LOT BALANCING

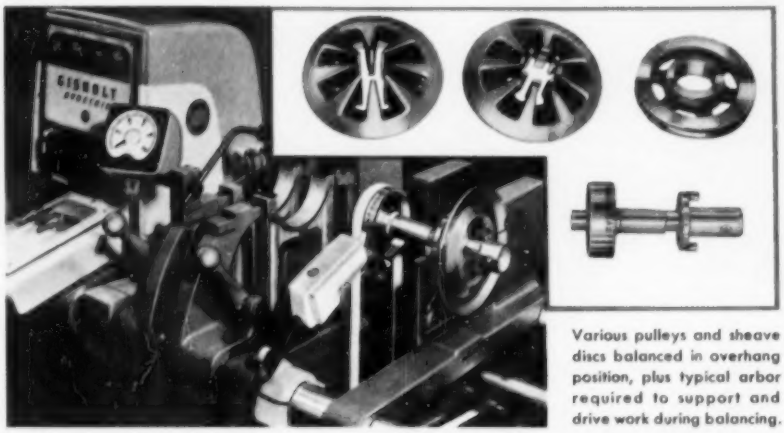
Get economical operation from quick setup and wide capacity of 31S Balancer

This balancing setup reveals how a leading producer handles job-lot parts economically on short production runs.

Workpieces include several sizes of pulley and sheave discs. A 31S General-Purpose Balancer gives high accuracy at low cost. With both lightweight and heavyweight work supports, the 31S handles parts from 2 to 300 pounds. Setup is very fast, and the direct reading amount meter is quickly calibrated to indicate exact unbalance amounts—in terms of correction method used for each part being balanced.

Here's a setup for single-plane balancing. The parts do not have their own shafts, so a balancing arbor is used. With the arbor placed between the work supports, the workpieces are slipped on the end and balanced on the overhang, eliminating need to lift belt and remove arbor for each part. Location is against a shoulder on the arbor, and drive is from a pin engaging an opening in the backside of the part. Parts are held axially by a spring-loaded ball (A), which depresses as the part goes on the arbor, pops up as it locates against the shoulder, and bears against the edge of the bore to hold the part securely on during rotation.

The amount meter indicates the precise amount of unbalance, and the strobe lamp shows the exact angle of location. The operator marks the workpiece and amount of correction needed, then makes the correction on a drill press to complete the job.



Various pulleys and sheave discs balanced in overhang position, plus typical arbor required to support and drive work during balancing.

▲ Close-up of 31S. Weight capacity of work supports at left is 15 to 300 pounds, at right from 2 to 50 pounds (which includes pulleys and sheave discs shown above). Note spring-loaded ball A, which saves time, eliminating need for clamping nut.

The versatile 31S reduces the balancing time on these parts, assures complete accuracy, eliminates guesswork. Wide capacity and flexibility of operation make this machine ideal for contract work or short production runs.

TRIMS PISTON FINISHING TIME 25% BY SUPERFINISHING

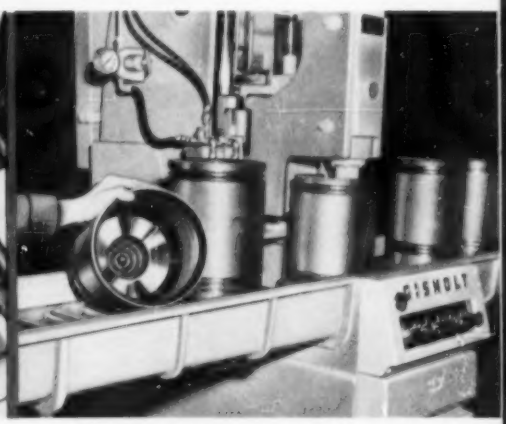
Handles two different sizes on Model 81 Superfinisher without change-over

Have you considered Superfinishing flat surfaces in your production setup? If not, you might want to read how a leading manufacturer is using this most modern process—to save time and obtain finer finish on the sealing faces of large cast iron floating pistons for diesel engines. A Gisholt MASTERLINE No. 81 Single-Spindle Superfinisher is doing the job.

A special Superfinishing quill unit handles 2 different sizes of pistons, which come through the machine on a conveyor, in random order. Here's how easy it is for the operator: he simply notes the type of the piston and presses the correct button, which automatically moves the Superfinishing stone to the exact depth required. Still greater efficiency is realized by using the same stone and cycle for both part types.

Placed on a special rotating fixture, the piston is held and driven from the base end. The automatic rough-and-finish Superfinishing cycle completes 24 pieces per hour, at 80% efficiency. Surface roughness is reduced from 100 micro-inches R.M.S. to 32 or less on each part.

Overhead view shows cup wheel lowered to Superfinish sealing face of diesel piston.



Model 81 Superfinisher with in-and-out conveyor. Part on left tilted to show Superfinished surface.

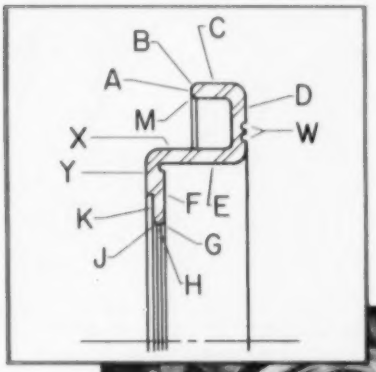
Time is saved, cost of extra equipment eliminated by one Superfinishing unit tooled for both part types. High production is achieved with minimum operator attention. Smoother surface gives longer wear life.

GISHOLT

TIME-SAVING IDEAS

MACHINES 14 PART SIZES AUTOMATICALLY

Lowers time, sharpens accuracy with Lynn Drive on No. 3 Ram



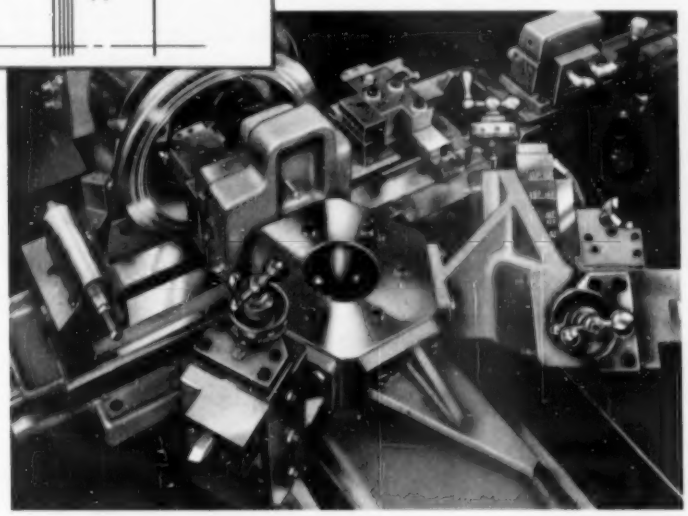
Machining odd-shaped parts in your plant? You might find some profitable ideas in the way this manufacturer is handling 14 sizes of steel stampings, using the No. 3 Ram Type Turret Lathe equipped with Lynn Hydraulic Drive.

Typical cycle on largest part handled (15¼" diam.) is as follows: A 3-jaw, 12" air chuck holds the work at X, locating at Y. An airdraulic unit on the rear of the bridge-type cross-slide feeds a special rear tool block and actuates turret-mounted sliding tool holder (shown in working position), simultaneously facing A-D-F-K and chamfering J.

The next turret station turns C, bores E-H, chamfers G. Tooling on the final turret station grooves W, while front cross-slide tools break the sharp corners at M-B. F.t.f. time is only 3.30 min.

Adjustable tooling handles all sizes from 3¾" to 15¼" diam. and ⅞" to 2 15/16" width, with minimum change-over. Boring bars are arranged so they can be placed between centers, permitting boring and co-boring tools to be set in tool room, using dial indicators. Remaining tools have backing screws, and tool blocks are cross-keyed for pre-setting. For various size parts, chuck jaws are changed or jaw inserts added or removed.

With low initial investment, wide varieties of shapes and sizes are handled automatically through smart tooling plus Lynn Drive. Automatic cycle on ram lets operator handle extra units or perform other work.



Adjustable tooling handles 14 work sizes. Special adjustable slide tool at right has scale etched on block to speed adjustment to various sizes.

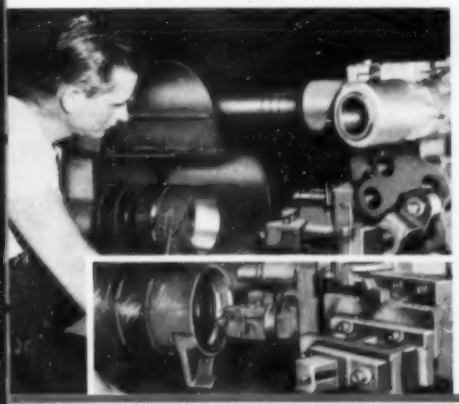
MASTER ELECTRIC CO. SPEEDS PRODUCTION WITH 50 FASTERMATICS

Fast setup, automatic cycle ideal for short runs on electric motor parts

Talk about profitable operations! This job reveals how Master Electric Co., Dayton, O., completes over 150 motors per hour—using more than 50 1F and 2F Fastermatic Automatic Turret Lathes. The operation involves motor frames, gear covers, end bells, bearing housings, parallel heads, vapor-proof heads, etc.

The setup you see here, on cast iron motor frames, shows how this user gets the most from his Fastermatics. One operator handles 4 machines, with 3 of them double-tooled to perform first machining operations on 3 different part sizes. Facing, boring and chamfering are performed in 3½ minutes f.t.f. Each complete cycle of the hexagon turret produces 2 motor frames.

Triple-tooling on the fourth Fastermatic handles the second machining operation on all 3 sizes as they come from the other 3 machines. Two stations are used for each size to finish the bore, face and chamfer. The cycle then stops; the operator removes the part, slips a spacer on the mandrel, and inserts the next size workpiece. The cycle then repeats, with f.t.f. time for the second operation held to just 1.5 minutes.



First operation on cast iron motor frame, showing workpiece and tooling. Three stations complete part. Double-tooled turret provides 2 parts for each complete index.

Second operation. Note spacer which compensates for changes in width. Turret is triple-tooled to let each complete index finish 3 different part sizes.

Complete automatic cycle of Fastermatic lets single operator handle multiple units, holding consistent high production and accuracy and using no more setup time than with hand-operated lathes. Automatic cycle means more time cutting chips, more output, less unit cost.

MASTERLINE
GISHOLT SINCE 1887

TIME-SAVING IDEAS

AiResearch SAVES ON TURBINE WHEEL PARTS BY USING JETracer

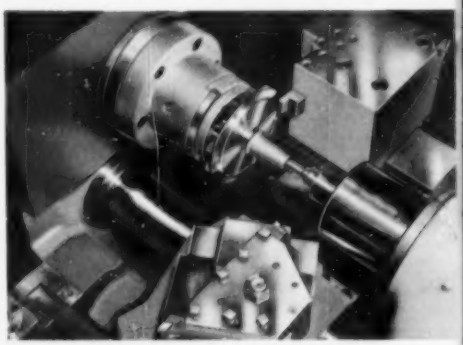
No. 12 Automatic Production Lathe, 4-pass JETracer, variable-speed drive motor combine to reduce costs and improve quality

You'll spot planning behind this job—at the Garrett Corporation's AiResearch Manufacturing Division, Phoenix, Ariz. Here, contour-facing and stepped-shaft turning operations are combined to produce steel turbine wheels in rock-bottom f.t.f. time.

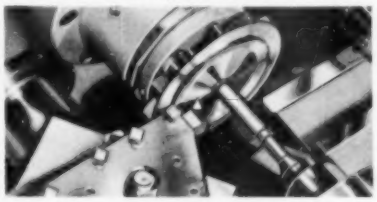
To maintain constant surface footage and assure reasonable tool life when changing from turning to contour-facing operations on the same part, AiResearch is using a Gisholt MASTERLINE No. 12 with a 4-pass JETracer and a variable-speed drive motor. The workpiece is 6½" in diameter and 4¼" long.

Parts arrive cut to length and centered. Distance between centers is held for location. A spindle-mounted compensating work driver with a built-in adjustable center holds the work at one end, and a tailstock center supports the other end. Drive is by a stud against the impeller vanes on the backside of the part. Before tracing begins, 2 tools on the rear independent slide rough-face. Then the JETracer, using a 4-position indexing template-carrying drum, rough-turns the shaft and rough-contour-faces the work in 3 fast, automatic passes. Spindle speed during machining is governed by a special cam on the JETracer slide. A finishing tool automatically indexes into position on the fourth and final pass, and the JETracer completes the part.

Part is finished in 6.5 min. f.t.f. Variable-speed drive motor maintains finish of less than 250 micro-inches on all surfaces. Complete automatic cycle prevents operator fatigue and human error on tricky contour-machining operation.



Work and tooling shown after rough-facing from rear independent slide. Note considerable stock to be removed on step-shaft and face of part.

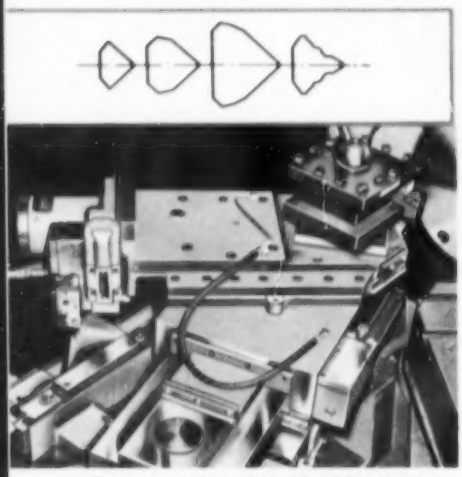


Finishing tool making finishing cut, completing part. Note uniform surface finish through JETracer and variable-speed motor arrangement.

Ask for new Catalog No. 1171-A, giving complete information on JETracer applications on various MASTERLINE machines.

CUTS F.T.F. TIME WITH JETracer ON SIMPLIMATIC

JETracer on independent slide machines oil well drill cone forgings more accurately



JETracer on independent slide of Simplimatic.

Here's one way to add considerable tooling flexibility to the MASTERLINE Simplimatic Automatic Lathe. Single- or multiple-pass independent JETracer slides may now be mounted on the flat platen table. Along with other standard slides, it operates within the automatic machining cycle. In all cases, the template carrier is located underneath and to the rear of the JETracer slide, with longitudinal and transverse adjustment provided for each template.

This single-pass setup generates all the different angles on the front faces of a variety of steel oil well drill cone forgings, while rear slide tools face the back angle. Several pre-set tools are carried on the indexing turret. When one becomes worn, a fresh tool is indexed into position, minimizing down time during the production run. A variable-speed motor, governed by movement of the JETracer slide, provides a constant surface speed for a fine finish. A similar setup on another machine uses the JETracer slide to generate the angles and rough out the grooves, as shown in the line drawing at the left.

Three typical parts handled with JETracer slide in photograph. Part on far right handled in a similar setup where independent JETracer slide generates angles and roughs out the grooves.

JETracer on Simplimatic improves accuracy, saves time. Typical 8½" drill cone is finished in only 1.90 min. floor-to-floor time.

No. 7-857
683

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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Madison 10, Wisconsin

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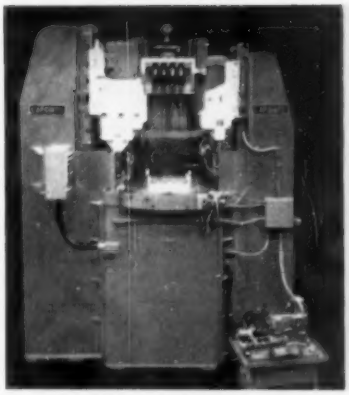
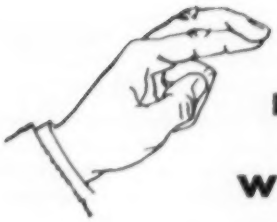
complete wrenches per hour,
BROACHING CLIPPED
PRODUCTION TIME
66⅔%





No need to keep your fingers crossed when LAPOINTE—BROACHING

You'll never get "hexed" when using Lapointe-Broaching for these double-hex openings, or for any other broaching application engineered by Lapointe. No jinxes, no uncertainties . . . because Lapointe engineers have the experience which enables them to anticipate and avoid the trouble spots.

This box wrench, ⅜" to $1\frac{1}{16}$" size, is an example of the amazing savings that can be made by broaching. Using one operator to load and unload, the rough forging (Fig. 1) is drilled (Fig. 2), broached (Fig. 3), and chamfered (Fig. 4) — all operations being performed on *both ends* and fully automatic, indexed on the 42-inch hydraulically operated rotary table.

Saving over two-thirds the previous production time required by single-point tooling operations, this special Lapointe Vertical Pull-Down Broaching Machine (15 tons, 48-inch stroke) is expected to pay for itself in two years through labor savings alone!

If you would like to discuss a possible broaching application, a qualified Lapointe Field Engineer will gladly call on you, on request.

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

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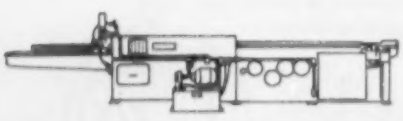
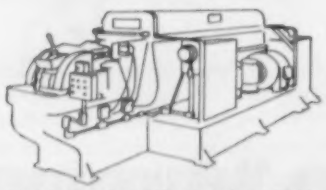
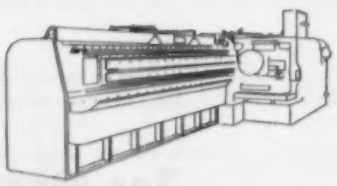
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



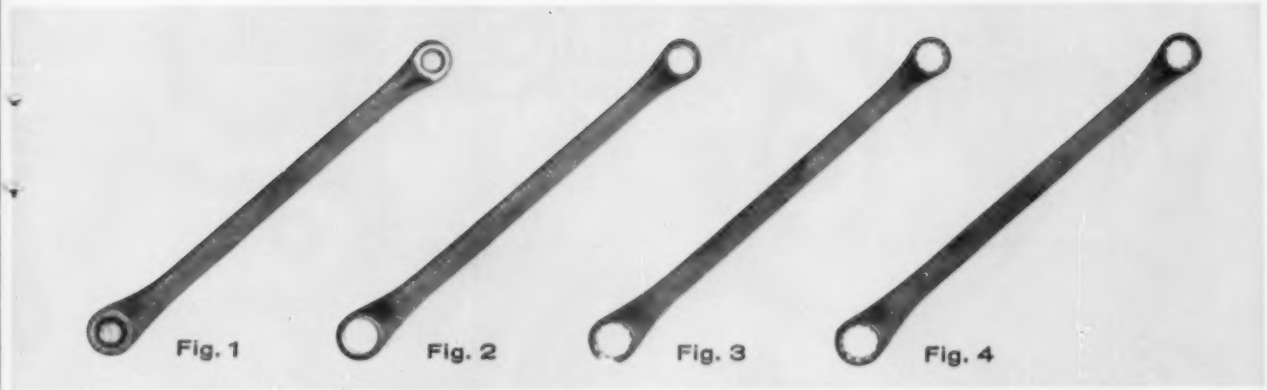
60" STROKE HORIZONTAL, ELECTRIC



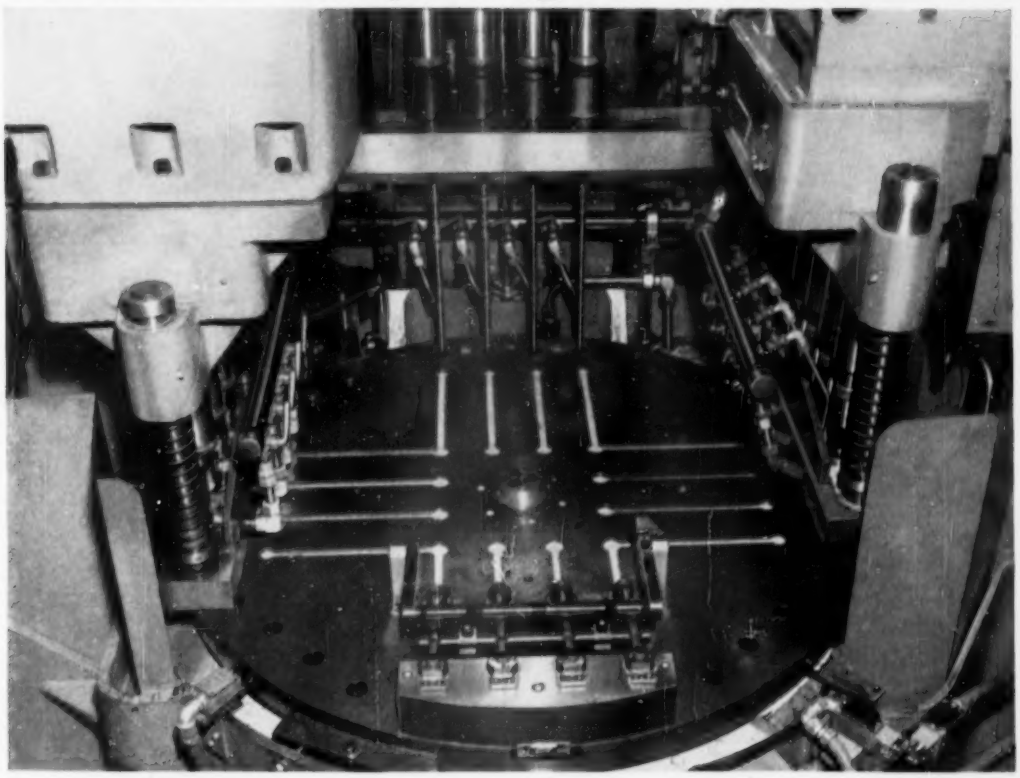
CH CONTINUOUS BROACHING, ELECTRIC



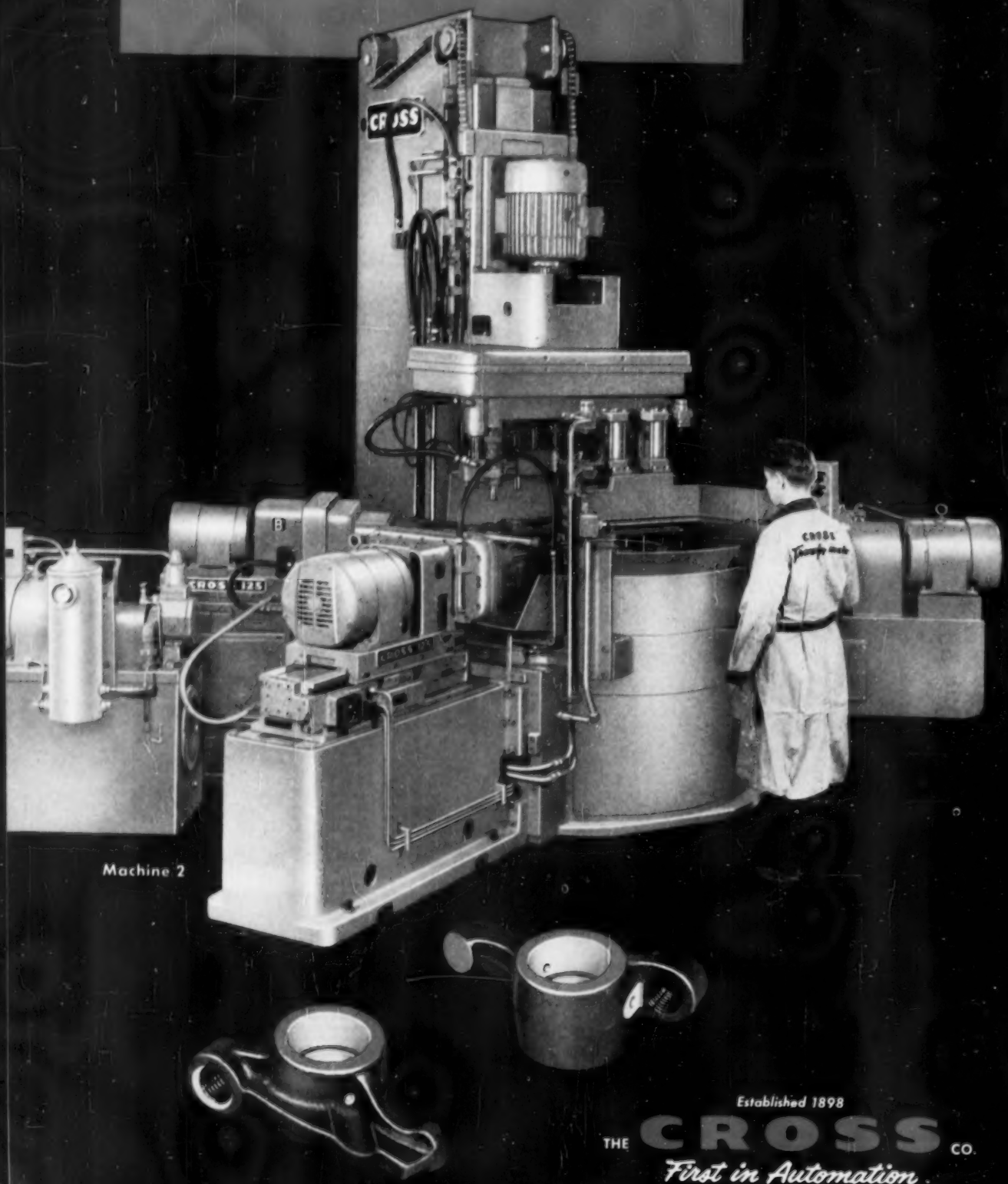
SRHE SINGLE RAM HORIZONTAL, ELECTRIC



this Double-Hex opening in Box Wrenches!



Two Dial Type Machines Process Valve Rocker Arms



Machine 2

Established 1898

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First in Automation

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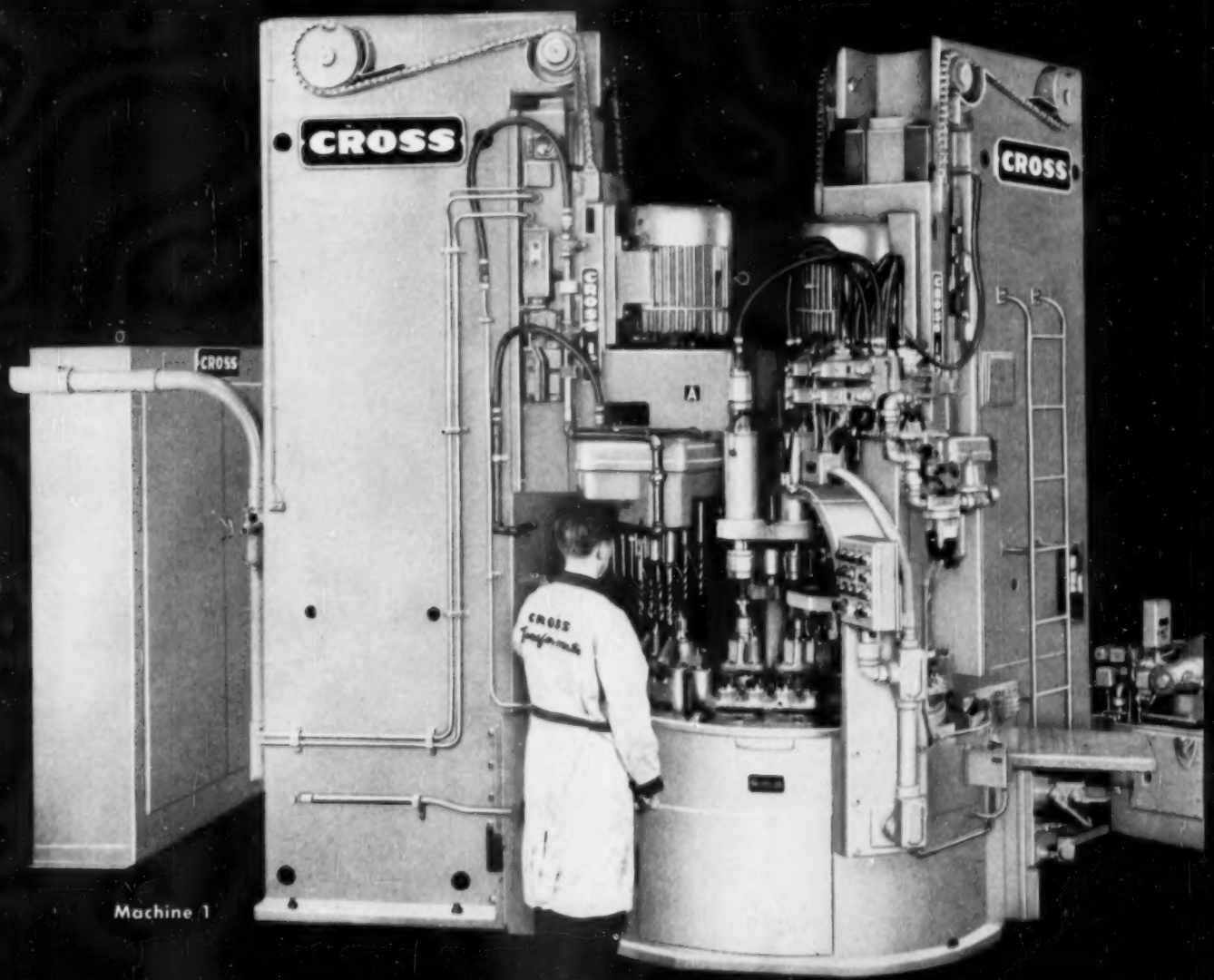
More Specials by Cross



Machine 1

- ★ 800 pieces per hour at 100% efficiency.
- ★ Four parts machined in each station.
- ★ Machine 1 drills and reams rocker shaft hole; forms oil groove; drills one oil hole. Machine 2 drills, chamfers and taps adjusting screw hole; drills, counterdrills and spotfaces second oil hole.
- ★ Push button controlled power wrenches operate fixture clamps.
- ★ Cross "building block" construction provides flexibility for part design changes.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for drilling and reaming; individual lead screw feed for tapping; automatic lubrication; pre-set tooling throughout.

BROACHES FOUR FACES EVERY 24 SECONDS

Removes 225 Pounds of Tough Forged Steel per Hour

The mammoth International TD-24 Crawler Tractor features "live" power and "live" traction on both tracks . . . and these tracks depend on tough forged steel links to deliver both. What's more, it takes smooth, controlled power to machine the links to close tolerances at high production rates . . . and that's exactly what's delivered by the Detroit Broaching Machine that does the job! Here are the facts:

PART: Forged steel track link, Rockwell C32-38.

MACHINE: Detroit Vertical Twin Slide, 25-ton broaching capacity, 100-inch stroke.

OPERATIONS ON EACH SLIDE:

R.H. Station: Broach locating slot, straddle broach parallel sides.

L.H. Station: Broach diagonal keyway. (As one slide is broaching, fixtures on other slide are unloaded and reloaded.)

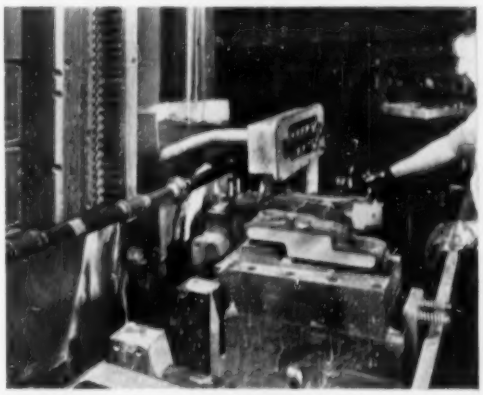
STOCK REMOVED - Approximately 5 cubic inches per piece. Cuts from the parallel sides and keyway are 0.150", balance is removed from the locating slot. Hourly stock removal is 225 pounds.

TOTAL BROACHING TIME PER PIECE: 24 seconds.

This Detroit Broaching Machine is one of several installed by International Harvester . . . and one of *hundreds* "in the production picture with industry's leaders." Let Detroit Broach offer the solution to your production machining problem, including the right machine, the most efficient tooling, and automation to any degree required. Send parts, prints or details of your problem for prompt recommendations.

Write for these Broaching Machine bulletins:

- Vertical Twin Ram
- Vertical Single Ram
- Vertical Pull Down
- Horizontal Internal
- Horizontal Continuous
- Hydraulic Presses

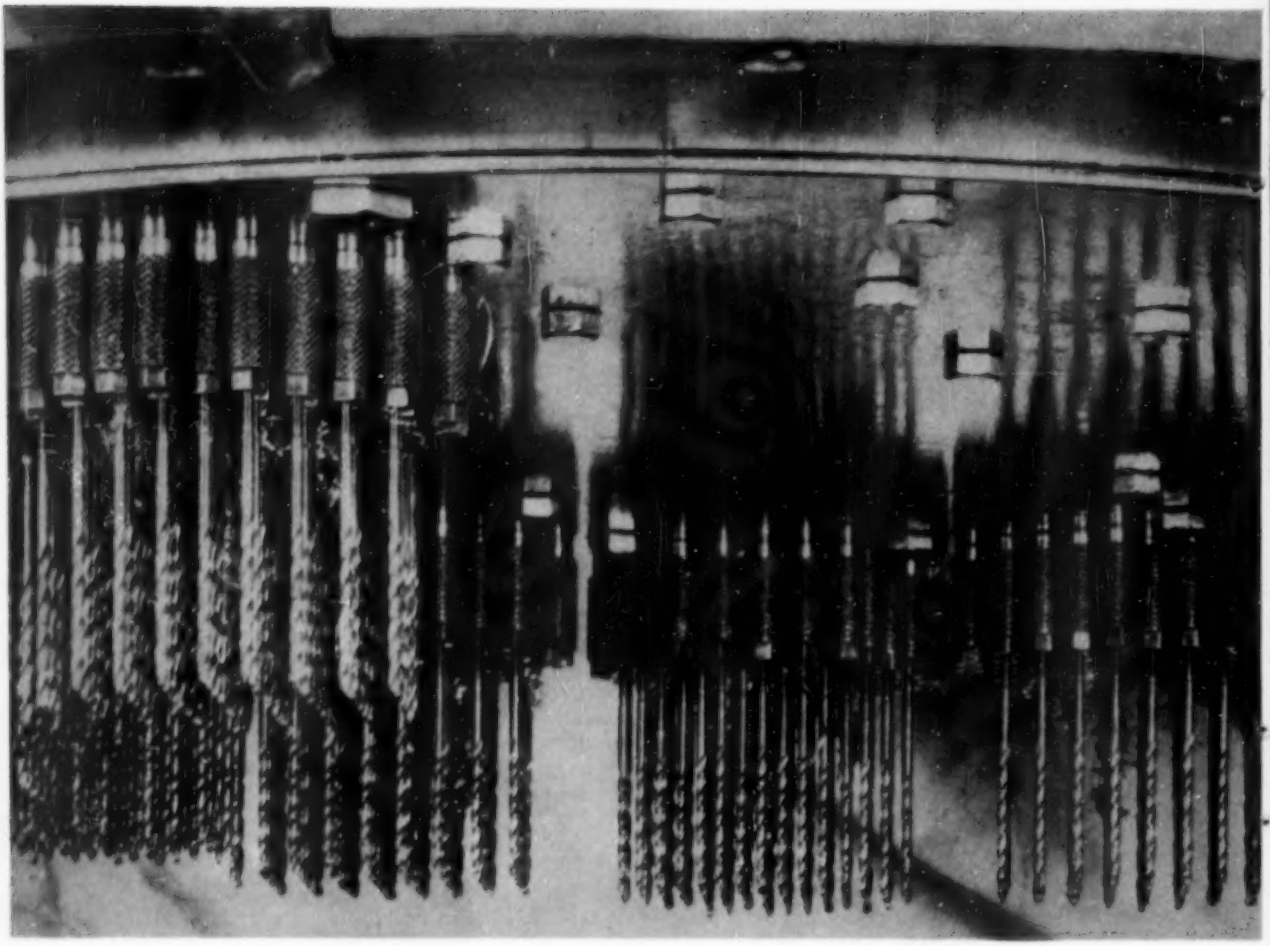


Tooled and fixtured by Detroit Broach specialists, the two-slide machine broaches four surfaces on each workpiece. The fixtures clamp parts hydraulically, are tilted down for broaching by shuttle action of the machine's knee. As one ram is broaching, fixtures at other are unloaded and reloaded.

This rugged, push-shearing action is accomplished smoothly with the "live" power of the International TD-24. A similar action in machining its tough forged steel track links is performed by Detroit Twin Slide Vertical Surface Broaching Machine.

DETROIT BROACH & MACHINE COMPANY

DEPARTMENT D-7 • ROCHESTER, MICHIGAN



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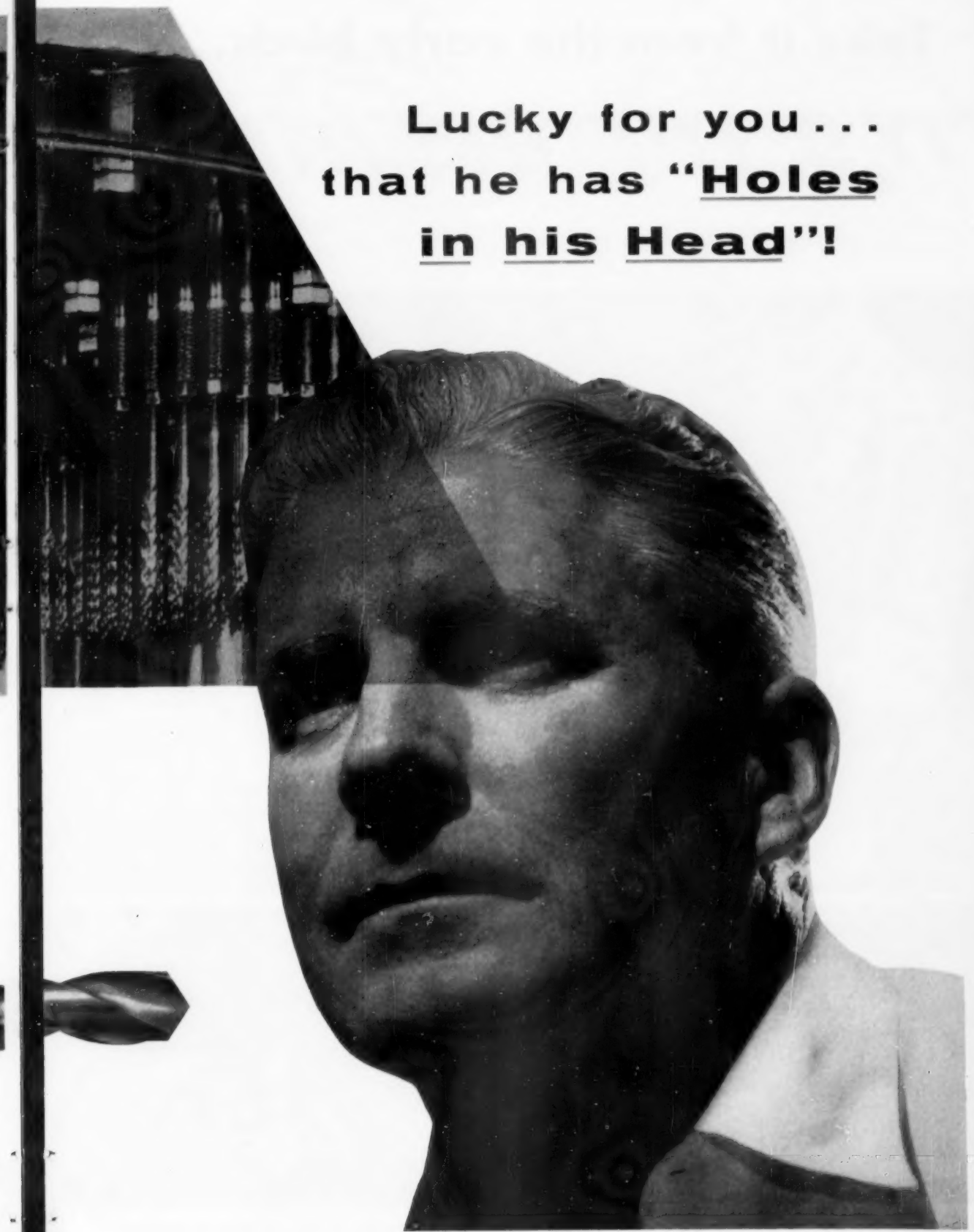
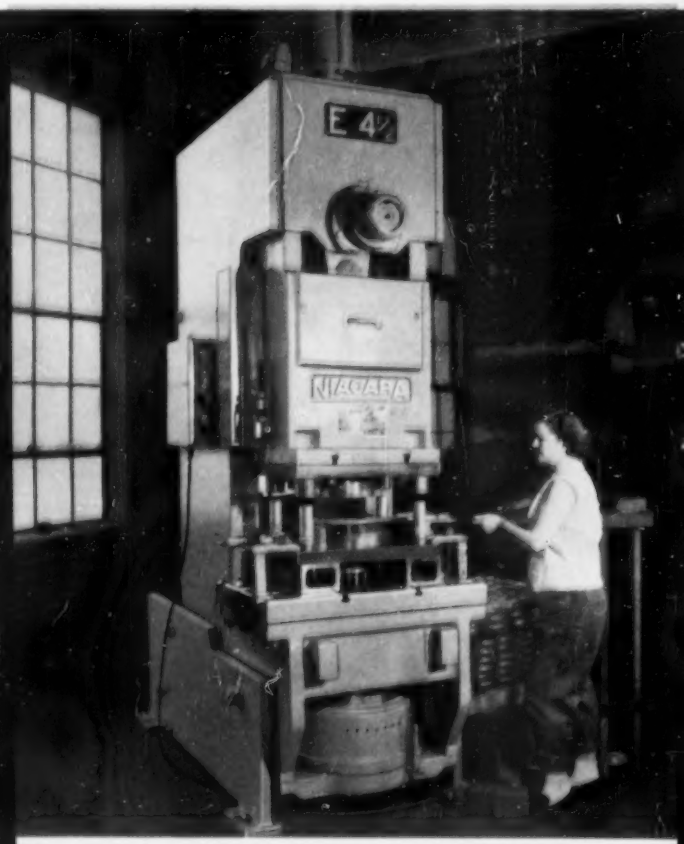
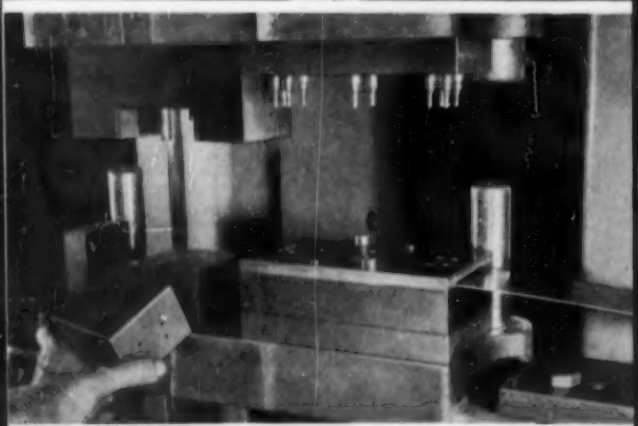

Lucky for you...
that he has "Holes
in his Head"!

Take it from the early birds...

"IT'S THE GREATEST





Niagara Series E 4½ OBI Press in operation at a well known eastern commercial stamping plant. Work includes stamping small wrenches; trimming canopies for electrical fixtures; piercing, cutting off and forming saddles with a progressive die (shown).

Niagara Series E 4½ OBI Press engaged in blanking and drawing of kitchen cannister lids from half-hard aluminum at midwestern housewares manufacturing plant.

"we can produce from 8,000 to 10,000 pieces in an eight hour day"

"much safer press"

"takes less floor space"

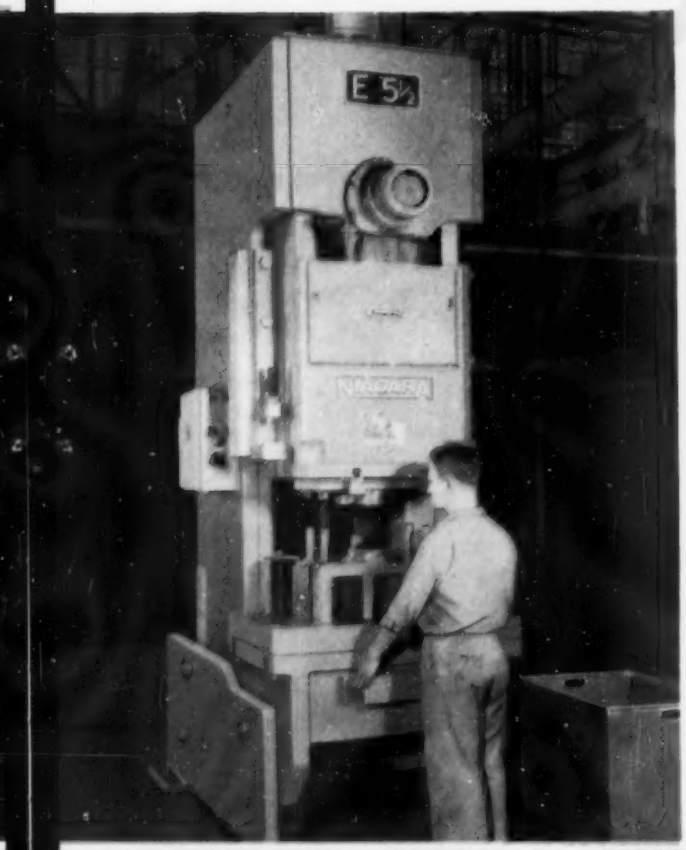
"has a centralized pressure lubricator which we like very much"

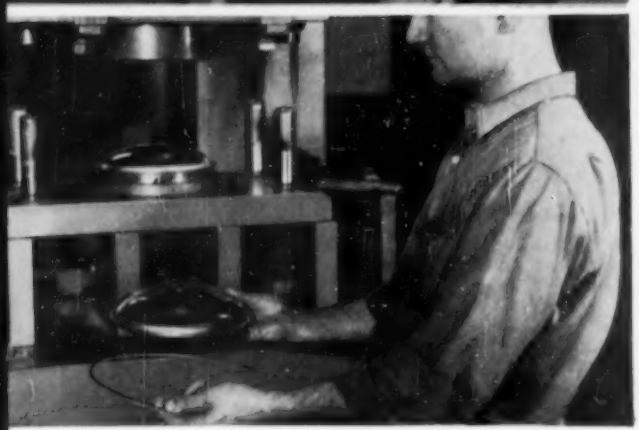
O.B.I. EVER BUILT"

"we find that dies without posts work much better on this press"

"all dies give better and longer runs"

"large slide area for large trimming, blanking and progressive dies"





Niagara Series E 5½ OBI Press forming and trimming hemispherical copper parts for one of the "Big Two" electrical manufacturers.

Few developments in metalworking history have drawn the enthusiastic endorsement given Niagara's revolutionary Front-to-Back Crankshaft OBI Press.

Now, as at the 1955 Machine Tool Show where it was unveiled, there is *nothing* even remotely resembling it in the industry ... design-wise and production-wise.

Customers in U.S. and Canada ... the "early birds" who are doing their modernizing with the most modern press of all ... can today tell you about accomplishments with this newest and greatest of OBIs that you would have never dreamed possible. Yes, the press that Niagara conceived to do more than any OBI ever built is doing just that for a fast-growing list of metalworking plants.

There's a huge fund of successful experiences that a Niagara representative can share with you today. Draw on it now and utilize it in your modernization plans. Make a date, at your convenience, for a personal call.

... and if you haven't received new Bulletin 56 with complete design description and specifications (75-200 ton capacities, 4½-7½ inch shaft diameters, standard and automated models) write for your copy at once. You will find it invaluable to your planning.

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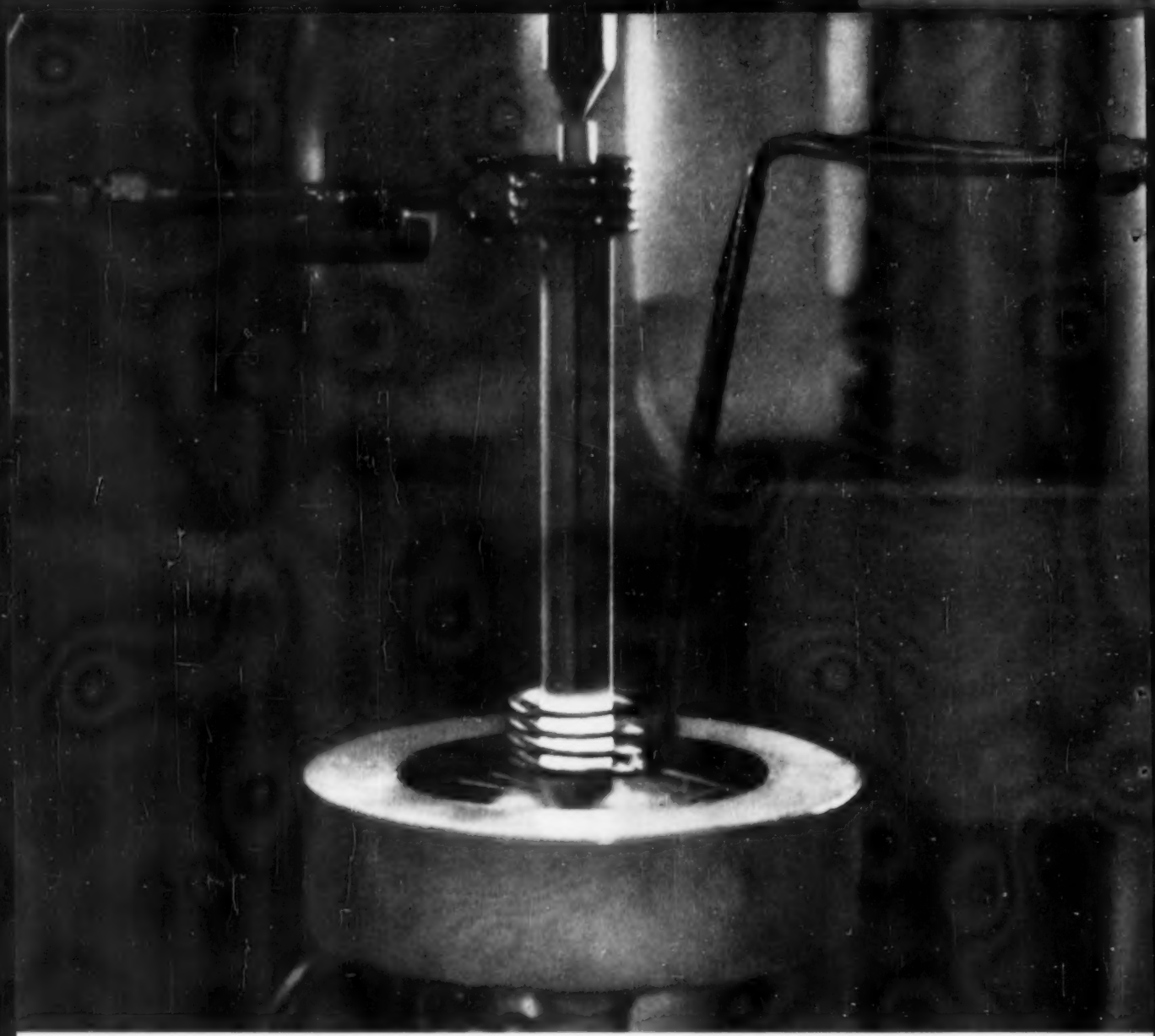


Ketos shaft being induction hardened to Rockwell 55-56, while ends remain soft for final machining. Photographed at Control Instrument Co., Inc., Brooklyn, N. Y.

KETOS has wide hardening range with minimum volume change...

Ketos is a low priced alloy tool steel that can be hardened from low temperatures with practically no volume change. It has deep hardening qualities, and a fine grained structure, that make it desirable for many production parts.

That's why nondeforming Ketos is well suited not only for most tool steel applications such as gauges, dies, and taps but also for close-tolerance, wear-resistant parts like the actuator bar shown in the induction heating unit above. The thin contact edges of this particular part withstood a "life test" of over 4-million high speed blows. No other steel tested lasted more than 1-million cycles before it chipped and failed.

If Ketos sounds like the steel you should be using, call your nearby Crucible warehouse. Stocks of Ketos and dozens of other special tool steels are large, delivery fast. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

Staples

ROTATING CARBIDE TOOLS

Old skills modern facilities give you premium Carbide Tool performance

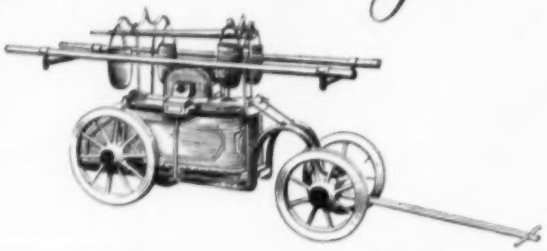
What makes a carbide tool outstanding?

Staple's answer: Ultra-modern facilities in the hands of the finest Cincinnati craftsmen. Your assurance of a new kind of carbide tool performance—whether special or standards!

1. Stub Screw Machine Reamers (Solid and Expansion Types) 2. Expansion Reamers (Patented) 3. Shell End Mills 4. End Mills 5. Twist Drills (solid and tipped) 6. Core Drills 7. Solid Chucking Reamers 8. Counterbores, Spotfacers.

THE Staples TOOL COMPANY
2352 Glendale—Milford Road
Evendale, Cincinnati 15, Ohio

Great in its day...



BUT WOULDN'T YOU RATHER HAVE THE LATEST TECHNICAL ADVANCE?

Now from **Heller** *A great new advance that lowers metal cutting costs*

HAND AND POWER

"Job Tempered" Hack Saw Blades

Certified by American Standards Testing Bureau to meet their standards for superior cutting: Uniform Teeth, Uniform Set, Uniform Temper*

Clean, efficient, *lowest cost* cutting can only be obtained from *uniform*, consistent quality blades such as produced by Heller's unique, Job Tempering process.

In Heller Job Tempered hand and power blades, uniformity begins right with the raw steel which is made to specification and minutely inspected for analysis and proper grain structure. Teeth are *milled* to uniform size, shape and spacing by the most modern, highly specialized equipment in the industry. Uniformity of tooth set is precisely measured with an indicator specifically developed for this purpose.

Then Heller's unique heat treating technique, *carefully matched to the metallurgy of the steel*, brings about exceptional uniformity of temper the full length of the blade — and from one blade to the next.

That's why *every* Job Tempered hand or power hack saw is certified by American Standards Testing Bureau to meet their standards for superior cutting: uniform teeth ... uniform set ... uniform temper — your assurance of outstandingly better, *lower cost* service on the job.

SOLD EXCLUSIVELY THROUGH

Heller DISTRIBUTORS

"YOUR OUTSIDE TOOL ROOM"

Heller "Job Tempered" Tools

* ASTB

HELLER TOOL CO. SINCE 1836

Heller

HELLER TOOL CO., *America's Oldest File Manufacturer*
Newcomerstown, Ohio — A Subsidiary of Simonds Saw and Steel Co.

IT'S EASY to CHOOSE
EASY to USE
THE RIGHT
HELLER BLADE

FULL LINE OF HAND AND POWER BLADES

There's a right Job Tempered Blade for your hand frame or power hack saw in Heller's complete line.

HAND BLADES

Supplied in Standard Steel, High Speed "M"-Hax and High Speed "T"-Hax Steels. 10" and 12" lengths to fit all standard frames. Tooth spacings of 14, 18, 24, and 32 teeth per inch. Hard-Edge flexible blades for general use or the All-Hard preferred by skilled operators.

POWER BLADES

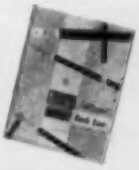
Available in High Speed "M"-Hax and "T"-Hax Steels and in "Nuweld" shatterproof type for maximum safety. Lengths from 12" to 36" for all machines. Tooth spacings 2½ to 18 teeth per inch for cutting most materials.

HOW TO SELECT AND USE THE RIGHT BLADE

Your Heller Distributor has handy Wall Selection Charts to help you choose the *right* blade for the job, and a valuable booklet, "Heller Hints on Hack Saws" that help you get long life, top performance and the lowest cutting costs you've ever experienced!

GIVE US YOUR TOUGHEST HACK SAWING PROBLEM

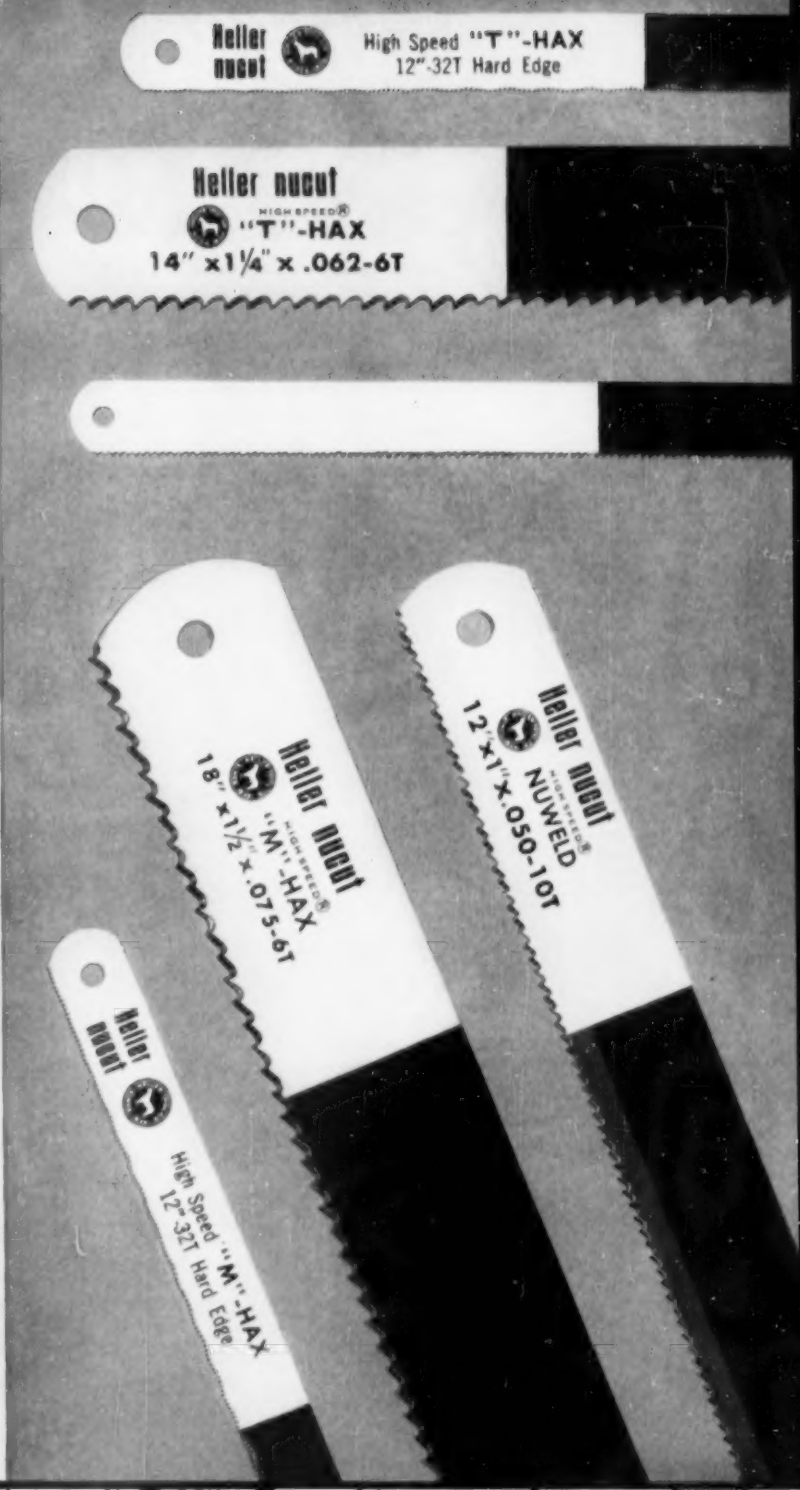
We'll show you how the *right* Heller Job Tempered Blade can solve it and deliver faster, smoother, trouble-free cutting over longer periods than ever before.



HERE ARE THE FACTS:

New Heller Hack Saw Catalog gives full information on sizes and types of blades offered.

WRITE FOR YOUR COPY TODAY



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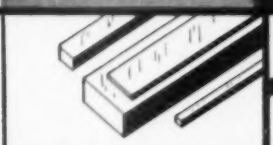
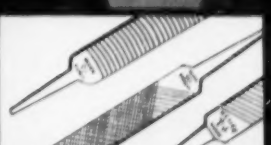


FLAT GROUND DIE STEEL

METAL CUTTING BAND SAWS



FAMOUS HELLER FILES

over 14,000 8,000 Different Cylinder SELECTIONS—

Miller

AIR AND HYDRAULIC

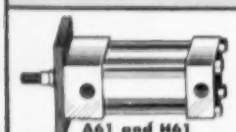
"STANDARDIZED" CYLINDERS

"IN STOCK" for immediate delivery...

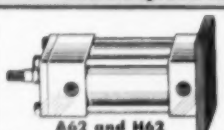
See Miller Bulletins A-105 (Air) and H-104 (Hydraulic) for Complete Dimensions and Engineering Data on these standardized "in stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 ft.

"IN-STOCK" MODELS

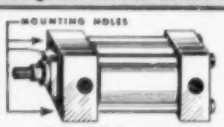
"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.



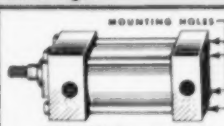
A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)



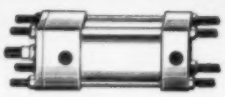
A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)



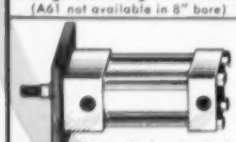
A63—8" Bore only
Flange Mounting on Rod End



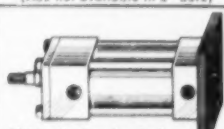
A64—8" Bore only
Flange Mounting on Cap End



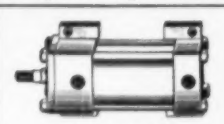
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.



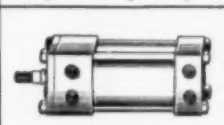
H65—Hydraulic Only
Flange Mounting on Rod End



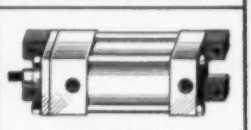
H66—Hydraulic Only
Flange Mounting on Cap End



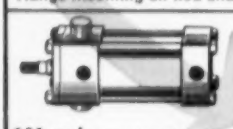
A72 and H72
Side Lug Mounting



A74 and H74
Side Flush Mounting

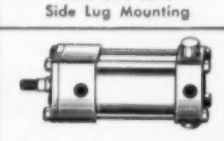


A77 and H77
Side or Foot Mounting

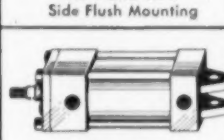


A81 and H81 Trunnion Mounting on Rod End

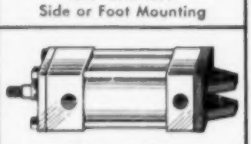
Your Choice of
CAP END CUSHIONED
ROD END CUSHIONED
or
BOTH ENDS CUSHIONED
on all cushioned strokes of all bores shown.



A82 and H82 Trunnion Mounting on Cap End



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

IN STOCK BORES

	BORES	ROD DIA.	ROD TURN DOWN & THREADS		"IN-STOCK" STROKES (in Inches)
AIR	1½	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12
	2	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	2½	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	3¼	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	4	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	5	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	6	1⅜"	1-14	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	8	1⅜"	1-14	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12
	2	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	2½	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	3¼	1⅜"	1-14	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	4	1¾"	1¼-12	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	5	2"	1½-12	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36

(1) "A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

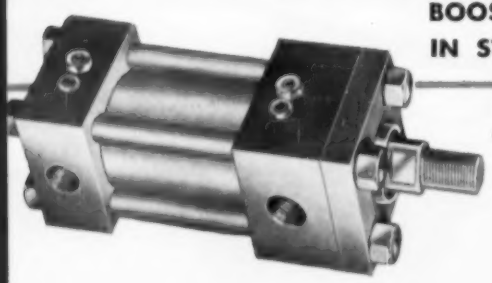
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

Write For Catalog and Stock Price List

Miller

Miller — FLUID POWER DIVISION
Flick-Reedy Corp

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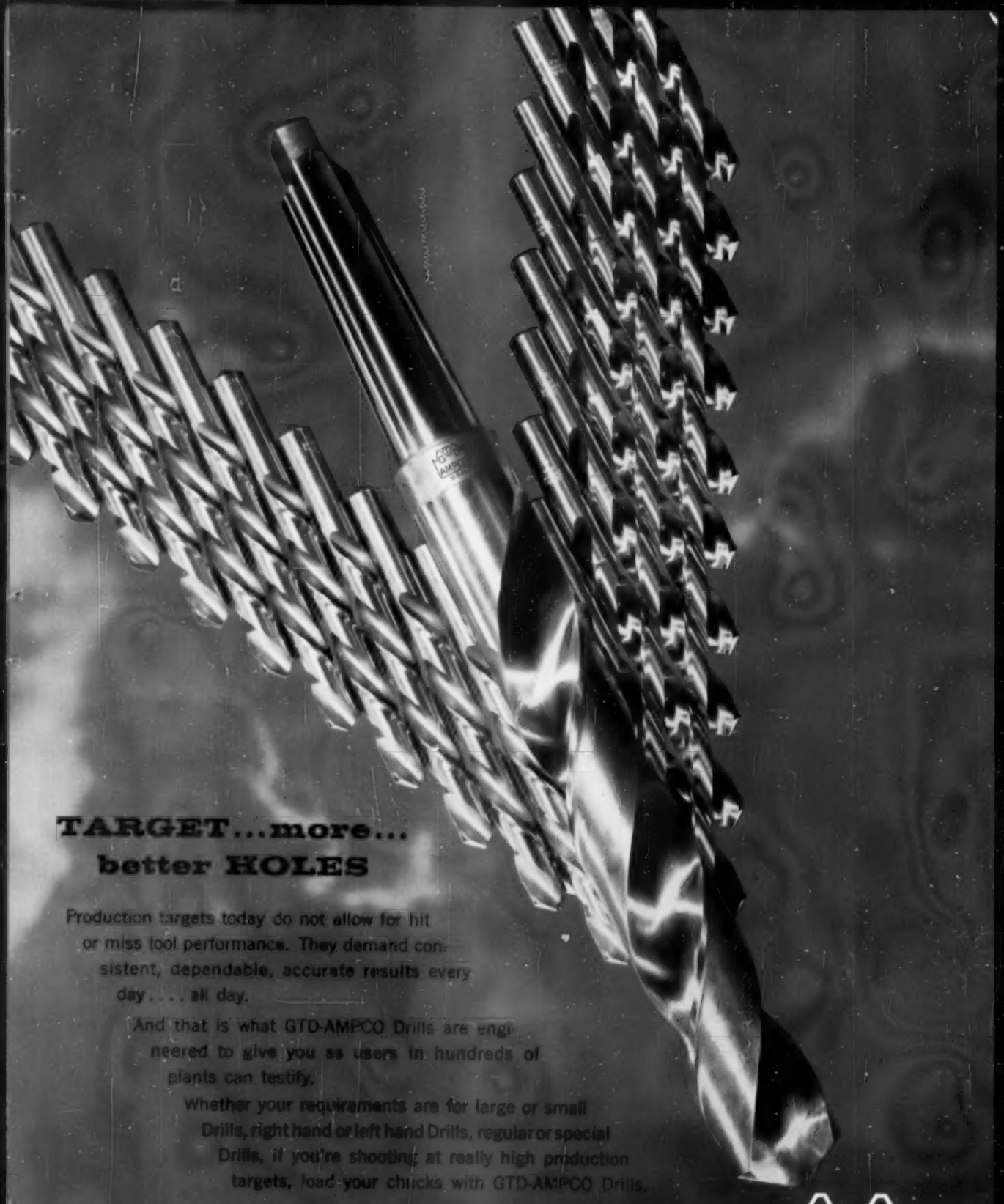
AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS



TARGET...more... better HOLES

Production targets today do not allow for hit or miss tool performance. They demand consistent, dependable, accurate results every day.... all day.

And that is what GTD-AMPCO Drills are engineered to give you as users in hundreds of plants can testify.

Whether your requirements are for large or small Drills, right hand or left hand Drills, regular or special Drills, if you're shooting at really high production targets, load your chucks with GTD-AMPCO Drills.

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GREENFIELD—AMPCO DRILL DIVISION • GREENFIELD, MASSACHUSETTS

GTD GREENFIELD AMPCO

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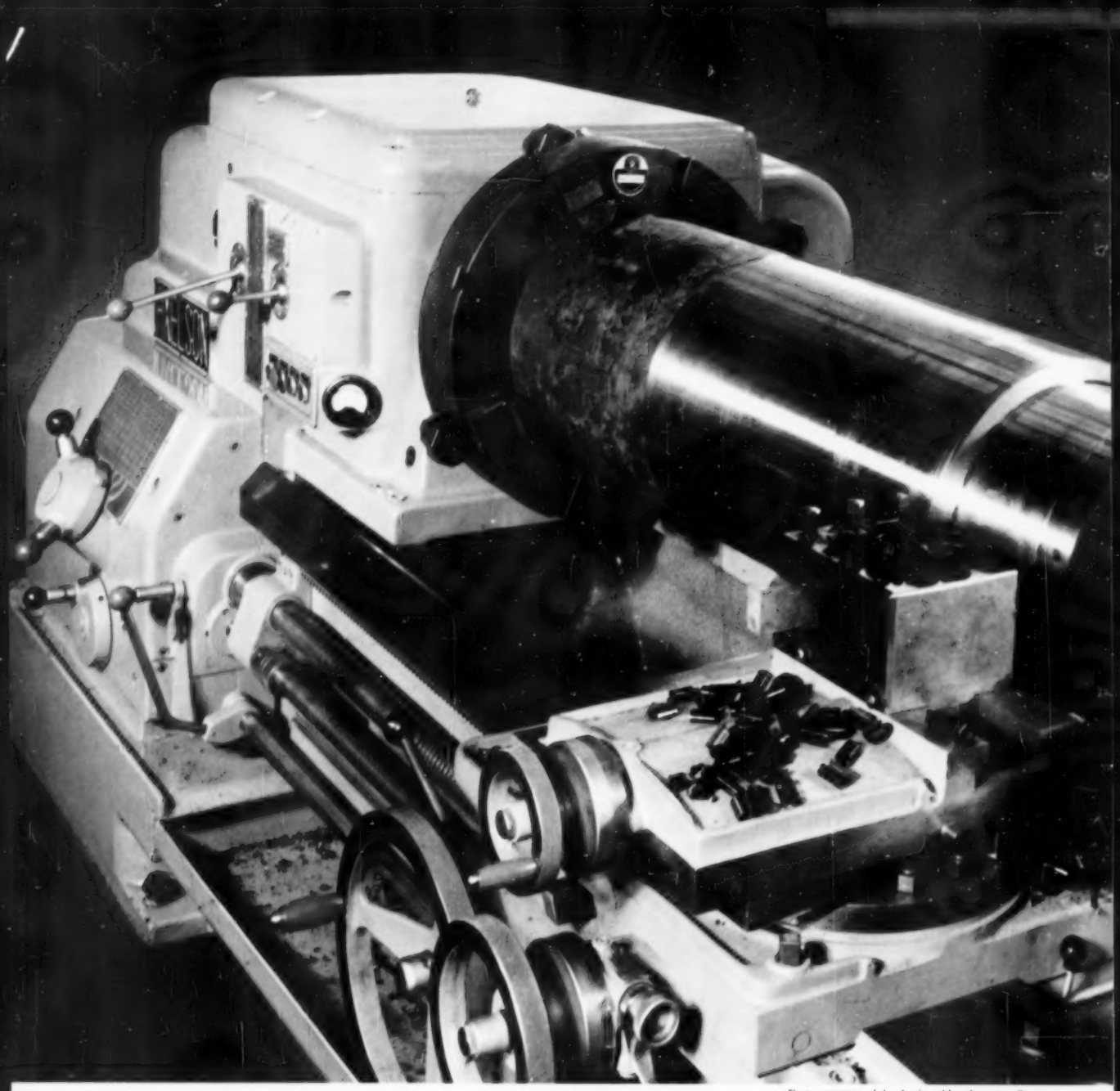

Photo courtesy of the Axelson Manufacturing Company

THE LATHE — *Axelson New 4025 Heavy-Duty Engine Lathe*

THE OPERATION — *Turning a 16-inch billet*

THE CHUCK — *Horton, of course*

HORTON CHUCK Since 1851

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
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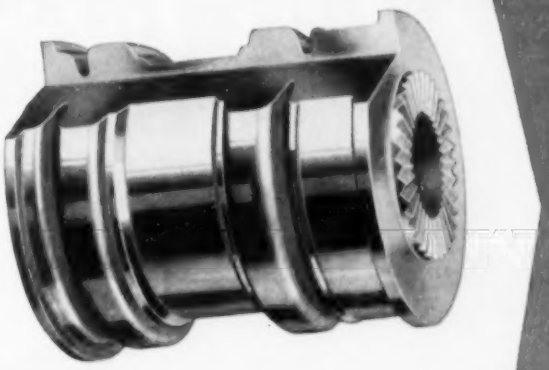
Call Your Horton Distributor Now!

Everybody knows that
National Tool Company
makes circular form tools—



But did you know
we make surface
broach sections . . .

and more special cutting tools of all kinds
than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools call your National Tool representative. His assistance is yours for the asking whether you're interested in one *special* tool or a complete tooling program.

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New FREE Catalog

To National Tool Co., 11200 Madison Ave., Cleveland, Ohio

Please send NEW 92 page catalog showing National Tool Company's complete line of *special* tools for the metal-working industry.

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Company_____

Address_____

City_____ Zone_____ State_____

cut costs WITH NEW METCUT Pin-Mount CORE DRILL

Securely Held by Cap Screw. Quickly, easily removed by hand.

Accurate, Flush Fit — No Gap for Chips to Lodge or Pack

ORDINARY DESIGN — Secured by Shank and Socket

PIN-MOUNT DESIGN — Deeper flutes, over 60% greater space for chip disposal.

Improved 2-Piece Design Provides Over 60% MORE SPACE *for Chip Removal*

This new METCUT Pin-Mount Core Drill is a tool you can depend upon for faster cutting action and longer, trouble-free service because the new design provides up to 60% more space for chip removal. The replaceable cutters in either carbide or high speed, are accurately positioned and driven by means of four pins, and are quickly and easily removed by a simple Allen head cap screw. No drifts are required. Gap between tool body and cutter section is also eliminated. Chip flow is smooth. There is no lodging or packing. Since drifting is no longer required, you eliminate the danger of damaging tools and spindles, insuring greater accuracy and tool life.

Sizes Available from 3/4" to 5"

Of special importance is that now you can apply the advantages of the two-piece design to a wider variety of jobs. Small sizes as low as 3/4" are now available. Other sizes are provided in diameters up to 5". Furthermore, the new design will help you reduce setup costs because cutters can be easily removed without taking the body of the tool from the spindle. You replace cutters, which can be sharpened in sets, without readjusting spindles. This is of particular advantage where guide bushings and plates are used.

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Get the full story on the advantages of the new METCUT Pin-Mount Design. Write for new brochure and complete specifications.

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325 S. WATER ST. • ROCKFORD, ILLINOIS

Manufacturers of High Quality End-Cutting Tools • Both Standards and Specials

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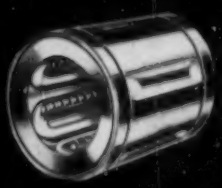
NOW! *Adjustable Diameter and Open*

THOMSON BALL BUSHINGS

Adjustable Diameter BALL BUSHING for Zero Clearance



Precision Series "A" and
Low Cost Series "B" BALL BUSHING

Open BALL BUSHING
for Zero Clearance on
Supported Shafts

LOW FRICTION · ZERO SHAKE OR PLAY
ELIMINATE BINDING AND CHATTER
SOLVE SLIDING LUBRICATION PROBLEMS
LONG LIFE · LASTING ALIGNMENT

Also manufacturers of NYLINED Bearings . . . Sleeve Bearings of DuPont NYLON

The BALL Bearing for *all* your LINEAR MOTIONS

Sliding linear motions are nearly always troublesome. Thousands of progressive engineers and designers have solved this problem by application of BALL BUSHINGS on *guide rods, reciprocating shafts, push-pull actions,* or for support of *any mechanism that is moved or shifted in a straight line.*

Improve your product! Up-date your design and performance with Thomson BALL BUSHINGS!

The various types cover a shaft diameter range of ¼" to 4". Small sizes available in Stainless Steel. Write for literature and name of our representative in your city.

THOMSON INDUSTRIES, Inc.
Dept. A, MANHASSET, NEW YORK

PROGRESSIVE MANUFACTURERS USE BALL BUSHINGS–A MAJOR IMPROVEMENT AT A MINOR COST

NICE BEARINGS

Help Advance

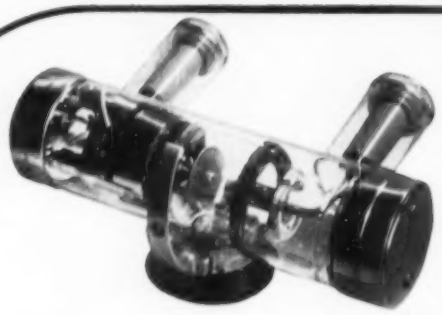
X-RAY DESIGN

Modern techniques in radio-graphic practice have placed new demands on X-ray tube capacity. These demands have been answered by Machlett Laboratories, Inc., Springdale, Connecticut, by the introduction of their DYNAMAX design. The Machlett DYNAMAX design incorporates a rotating anode mounted on highly specialized ball bearings made by NICE BALL BEARING COMPANY.

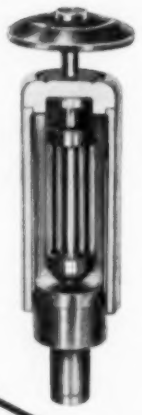
The commercial success of the rotating anode principle is largely due to the development of suitable bearings. The NICE bearings used by Machlett have proven to be the complete answer to all requirement problems. They are made to exacting tolerances from special heat resisting steel and are silver lubricated for use in high vacuum.*

Now Available! New NICE Cat. No. 19C

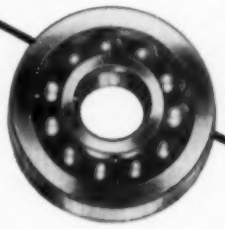
*Machlett U. S. Patent No. 2,315,20



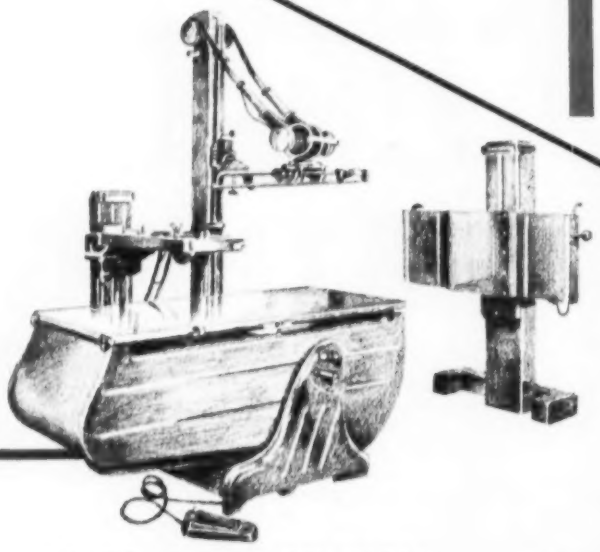
Machlett DYNAMAX "25" Rotating Anode X-RAY Tube (with plastic display case)



Cutaway View of Ball Bearing Mounted Rotating Anode and Motor Armature Core



Special NICE Bearing used at bottom of Rotor. A similar Special Bearing is mounted at top of Rotor.



Picker X-Ray Corporation Table and Tube-stand incorporating Machlett DYNAMAX

NICE

NICE is the word for **BEARINGS**

NICE BALL BEARING COMPANY
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- DRILL COUNTERBORE
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Delivery in Ten Days

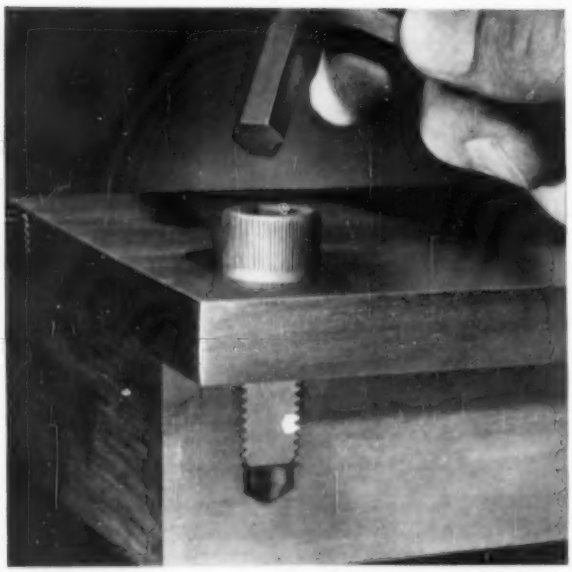
WRITE FOR COMPLETE CATALOG

Mohawk
TOOLS, Inc.
910 E. MAIN ST., MONTPELIER, OHIO

world's largest producer of Sublands

The ordinary fasteners securing the worm wheel to the drum shaft in this automatic screw machine loosened, causing $120 worth of damage to parts. Labor for the repair job cost $100. The ordinary fasteners were replaced with self-locking UNBRAKOS, and there has been no trouble since.

Vibration won't loosen self-locking UNBRAKO socket cap screws



HOW IT LOCKS. The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok* self-locking device eliminate fastener problems caused by vibration.

Take the drive system in the automatic screw machine illustrated above, for example. The screws originally used to secure the worm wheel to the drum shaft loosened, causing considerable damage, besides loss of production time. These have now been replaced with self-locking UNBRAKO socket head cap screws and the trouble has been eliminated.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or endless running of a machine won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives catalog and technical data on the complete line of UNBRAKO socket screws with the Nylok self-locking device. Or see your local industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

UNBRAKO® SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

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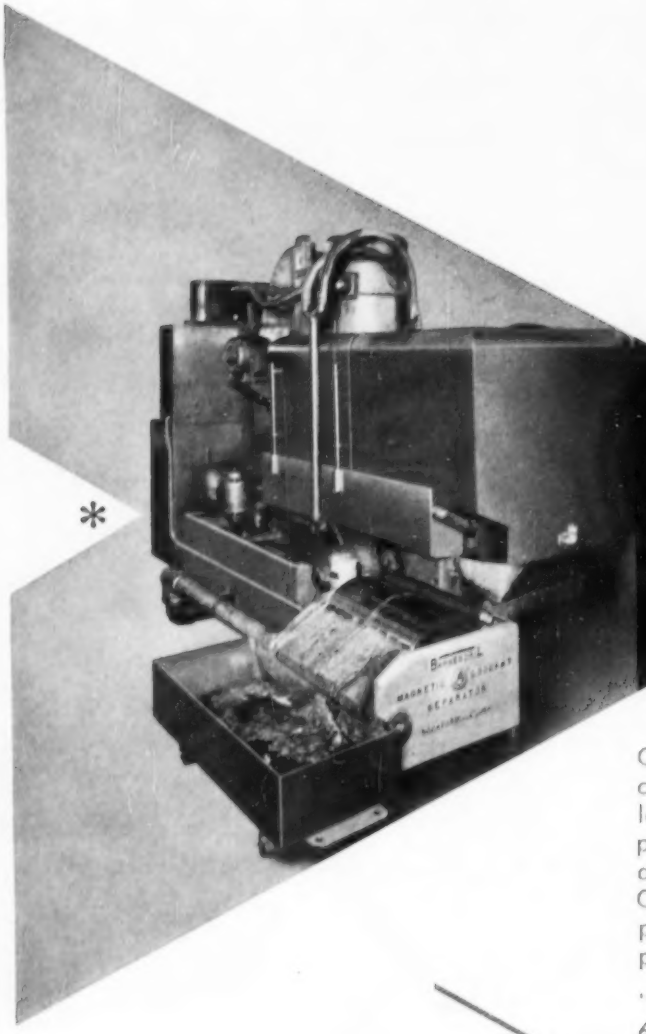
Write for your copy of our new catalog. Ask for No. 70-A



*

CUT maintenance, labor costs

INCREASE PRODUCTION!

Coolant fed into a BarnesdriL magnetic coolant separator continuously circulates around the drum of powerful permanent Alnico magnets. Swarf, chips, and other ferrous particles are removed. Coolant is cleaned by the separator, thus preventing machine downtime and improving finishes.

a user reports:

"Our surface grinder (above) required 6 hours of cleaning and 5 gallons of coolant per week. With the BarnesdriL magnetic separator installed, there has been no downtime in 4 months and coolant used has dropped to 1 gallon per week. *We cut our grinding costs $65.50 per week.* Paid for the installation in less than 2 months."

These savings are typical. Call your BarnesdriL Factory Representative today or write for Catalog 300G.

*BarnesdriL Magnetic Separator #4 installed on a Blanchard No. 18 Surface Grinder.

50th year

FILTRATION DIVISION

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870 CHESTNUT STREET • ROCKFORD, ILLINOIS
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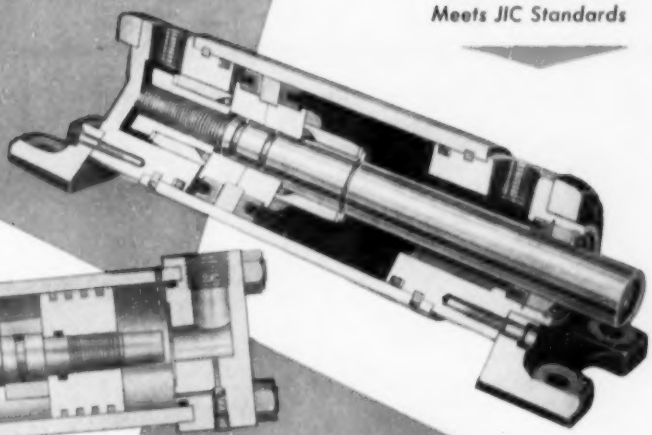
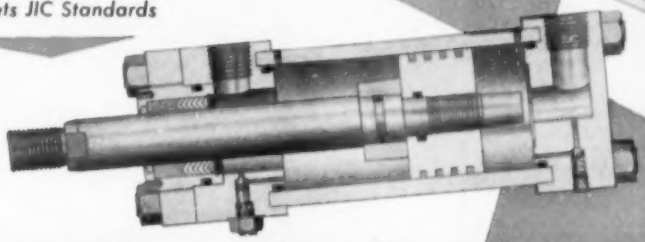
O-M CYLINDERS (AIR AND HYDRAULIC) *have everything*

O-M Tie-Rodless
150 PSI Air
Up to 1500 PSI Oil
With Internal
Locking Mechanism
Meets JIC Standards



O-M Series T-H
Hydraulic 2000 PSI
With Removable
Gland Cartridge
Meets JIC Standards



Construction and performance features that keep O-M cylinders right in the middle of AUTO-MATION

- Smooth, dependable operation at all practical speeds.
- Precision-honed, seamless steel body.
- Shock and vibration resistant.
- High-tensile alloy steel piston rod—ground, polished and hard-chrome plated.
- Multiple lip, self-compensating rod gland packing on all hydraulic cylinders.
- Self-compensating piston and rod packing on all cylinders, with packings available for fire-resistant fluids, also wide temperature ranges.
- Machined bearing bronze bushings for maximum service with minimum friction.
- O-ring static seals throughout – no flat gaskets to leak.
- Efficient wipers or scrapers on piston rods.
- Rolled steel precision machined end caps with ample sized ports.
- Adjusting needle for cushion control with ball checks for rapid full power starts.
- Versatile port orientation.
- Wide range of mounts and mounting accessories.
- Easily maintained – parts subject to wear can be repaired with minimum downtime.
- Plus many other features.

O-M Air and Hydraulic Cylinders are available in 1 ½" to 8" bores with standard and heavy-duty piston rods.

Mail coupon today for Bulletins 101A (O-M Tie-Rodless Cylinders) and 105 (O-M Series T-H Hydraulic Cylinders).

Engineering Service...

Consult an Ortman-Miller representative regarding your pneumatic and hydraulic problems. His broad experience with standard and special cylinder applications is available to you without cost or obligation. Use convenient coupon for name and address of O-M representative nearest you.

ORTMAN-MILLER MACHINE COMPANY

13 143rd Street, Hammond, Indiana

☐ Have representative call ☐ Send Bulletins 101A and 105

Name_____ Position_____

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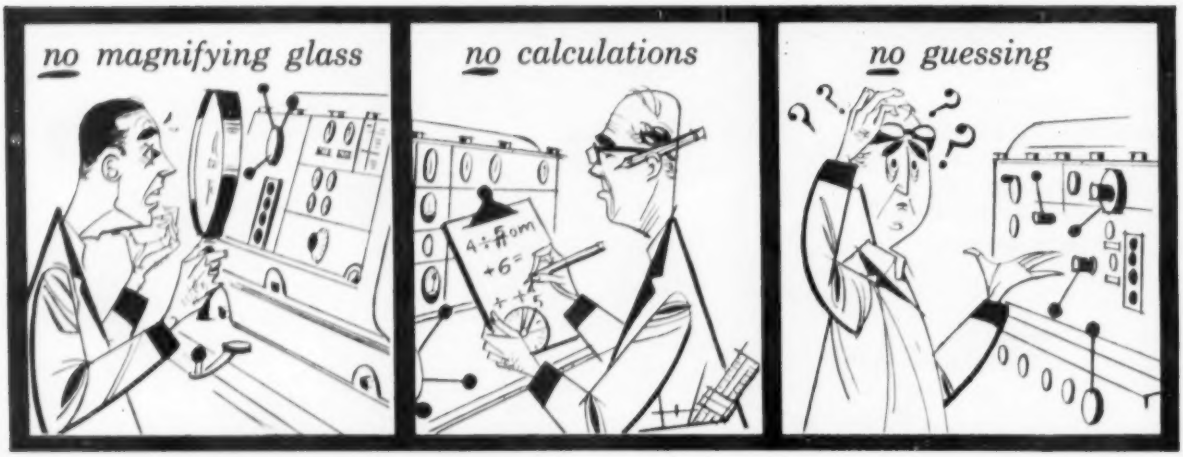
Know your feed... set your speed!

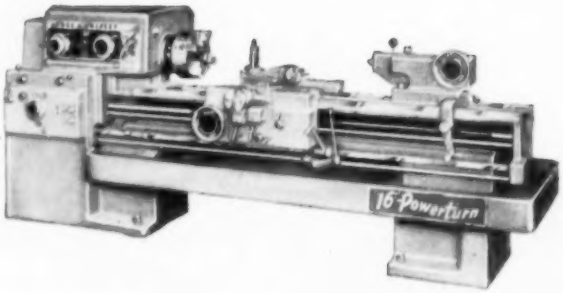


quickly . . . almost automatically with the LODGE & SHIPLEY *Powerturn* LATHE and SPEED-DIAL HEAD!

Take "by-guess" and "by-golly" confusion out of lathe operation! Lodge & Shipley POWERTURN Lathes with *Speed-Dial* Head make speed selection and setting simple as **a...b...c!**

a . . . set work diameter
b . . . read r.p.m. opposite cutting speed
c . . . set levers to automatic indicator lights

This time-saving, fool-proof simplicity is but one feature of New POWERTURN Lathes. Combined with traditional Lodge & Shipley accuracy and rugged strength are many other features for new precision and new operating convenience. New literature . . . ready now . . . tells the complete story: how POWERTURN Lathes are designed to facilitate turning to higher levels of profitable operation. 13, 16 and 20-inch sizes.



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STANDARD DOUBLE-END MILLS offer rugged "built-in" resistance to "side thrust".

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Assure top production and economy ... specify STANDARD.

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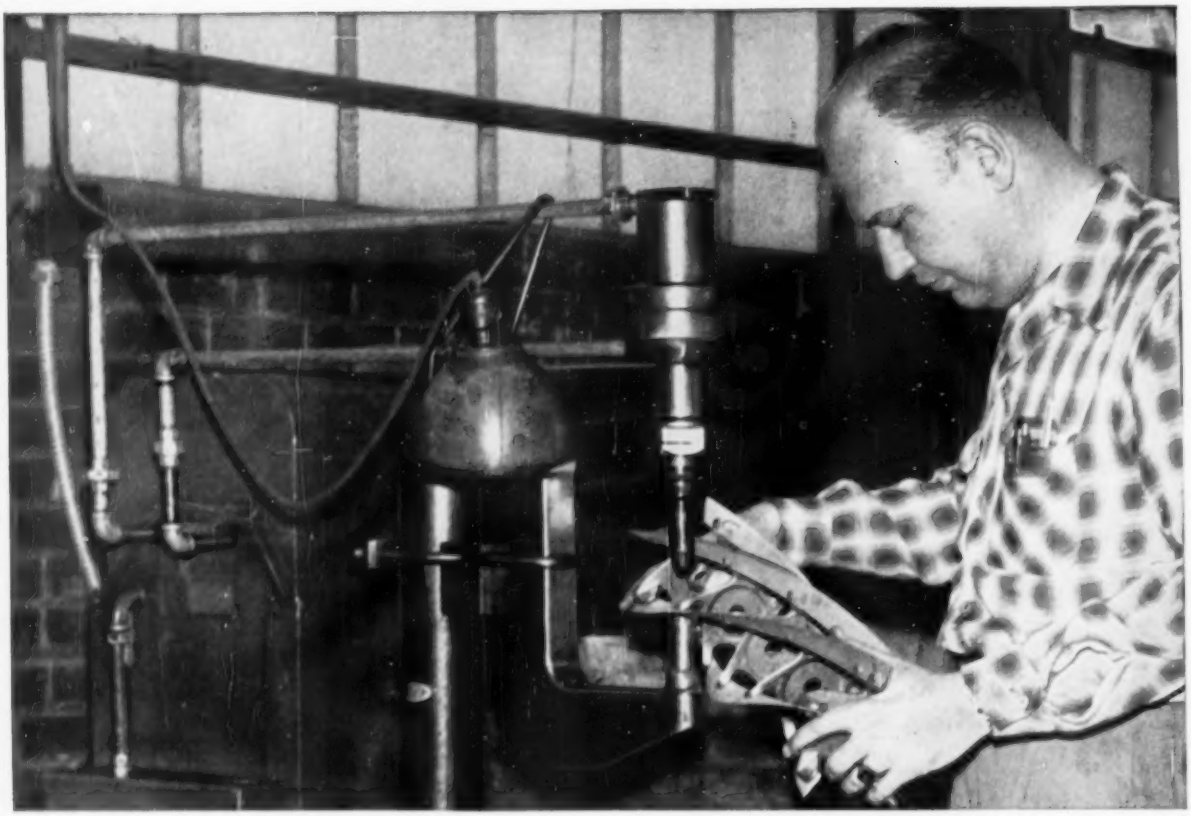
THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Carbide Tools · Gages*



Courtesy Eclipse Lawn Mower Company, Prophetstown, Illinois

HOW TO MAKE A BETTER ASSEMBLY CHEAPER

RIVETING THE "HY-POWER" WAY

Lawn mower blades must be fastened to the reel tightly and *in perfect alignment* to assure product performance and acceptance. That's why the Eclipse Lawn Mower Company, Prophetstown, Illinois (as well as many other leading lawn mower manufacturers), uses Hannifin "Hy-Power" cold-squeeze riveting.

What's your assembly problem?

If you haven't investigated fast, safe, clean cold-squeeze riveting, perhaps you should! Parts are drawn tightly together under quiet, relentless hydraulic pressure. Rivet shanks expand to fill the hole completely, making the tightest joint possible; heads are formed to any shape and every rivet is identical. And, with this modern push-button-controlled method, operators need no special training to apply it.

"Hy-Power" Riveters are available, standard or special, for portable use or in fixed mountings, as shown. Power source is the exclusive Hannifin "Hy-Power" Hydraulic Pressure Generator—so dependable that the first model, made nearly 20 years ago, is still in daily use.

ONE RIVET AT A TIME OR SEVERAL!

Hannifin "Hy-Power" Riveting is ideal for multiple installations where several "Hy-Power" Cylinders—available in capacities from 7½ to 100 tons—advance, rivet and retract in unison. Your Hannifin representative is anxious to help you select exactly the "Hy-Power" installation you need. Why not call him in? Meanwhile, get the full story by writing for Bulletin 150.

HANNIFIN

Hannifin Corporation, 519 S. Wolf Road, Des Plaines, Ill.

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

BRIDGEPORT BRASS
COPPER ALLOY BULLETIN

Reporting New Developments in Copper-Brass Alloys and Metalworking Methods

SPECIFY DURONZE WHEN YOU NEED A TOUGH, DURABLE ALLOY

by M. A. BUELL
Chief Staff Metallurgist

Duronze is one of the more versatile of the bronzes, combining the strong corrosion-resistant properties of copper with many of the mechanical properties of mild steel. It is available in several alloy compositions, the most popular of which are as follows:

	Duronze 606	Duronze 609	Duronze 707
Copper	96.00%	98.0%	91.0%
Silicon	2.85	2.0	2.0
Aluminum	–	–	7.0
Manganese	1.00	–	–

The Duronze family's high tensile strength and good machining make it a popular alloy for bolts, nuts, gears, valve stems and parts, and marine hardware.

Duronze 707 is best for machined and hot-forged parts. It does not, however, lend itself to cold-forming operations.

Duronze 606 and 609 offer, on the other hand, excellent cold-working properties in addition to excellent corrosion resistance.

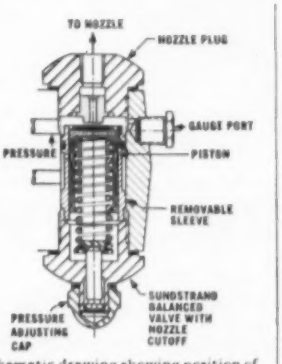
Full details on any Duronze alloy are available from your nearest Bridgeport Sales Office.

SOLVING YOUR PRODUCT AND PRODUCTION PROBLEMS

Of all the data, records and files kept by Bridgeport Technical Service, one of the largest is marked "Product and Production Problems—Solved." The experience brought to bear on a problem you may have with your product, or in the production of it, comes, in large measure, from cases similar to yours and frequently from cases exactly like yours.

Couple this successful experience with extensive facilities and you have a combination at your disposal that can be of great benefit to you. Bridgeport Technical Service works directly through your Bridgeport Salesman; when you outline for him your particular copper alloy problem you're calling on Bridgeport Technical Service.

Bridgeport Duronze 707 Helps Cut Cost of Vital Oil-Burner Pump Part



Schematic drawing showing position of nozzle plug insert in the burner valve assembly.

Bridgeport Duronze 707 nozzle port insert shown with nozzle plug.

The nozzle port insert for oil-burner pumps manufactured by Sundstrand Hydraulic Div., Sundstrand Machine Tool Co., Rockford, Ill., performs two vital functions: it provides positive fuel cutoff and prevents fuel leakage during stand-by periods.

For these reasons, metals specifications and machining requirements are exacting. Resistance to continual corrosive effects of fuel is a must. Also, the material for the part has to be machined to close tolerances and must be capable of good surface finishes.

A Bridgeport salesman noticed that this insert was being machined from leaded phosphor bronze. He studied the materials specifications and production methods, then recommended a shift to Bridgeport Duronze 707 (Aluminum Silicon Bronze).

First, Duronze made possible substantial savings in materials cost. Second, Duronze's resistance to fuel-oil corrosion was equally as good as the previously used metal. Third, although the machinability of Duronze was slightly less than leaded phosphor bronze, the Bridgeport man's recommendations made the difference in machining time negligible.

The results speak for themselves. Sundstrand now uses Bridgeport Duronze 707 for the nozzle port insert on their *entire* line of oil-burner pumps.

BRIDGEPORT BRASS

Bridgeport Brass Company, Bridgeport 2, Connecticut, Offices in Principal Cities
In Canada: Noranda Copper and Brass Limited, Montreal

OSBORN BRUSHING METHODS worthy of your confidence

BEFORE BRUSHING

AFTER BRUSHING

At the push of a button. *Osborn Master® Wheels remove burrs and blend surface junctures. Costs are down 74% from previous hand method.*

Push-button finish... 1400 per hour

THE manufacturer of this machined aluminum ammunition component was faced with the necessity for attaining a high production rate, and at the same time, meeting the standards of rigid quality control.

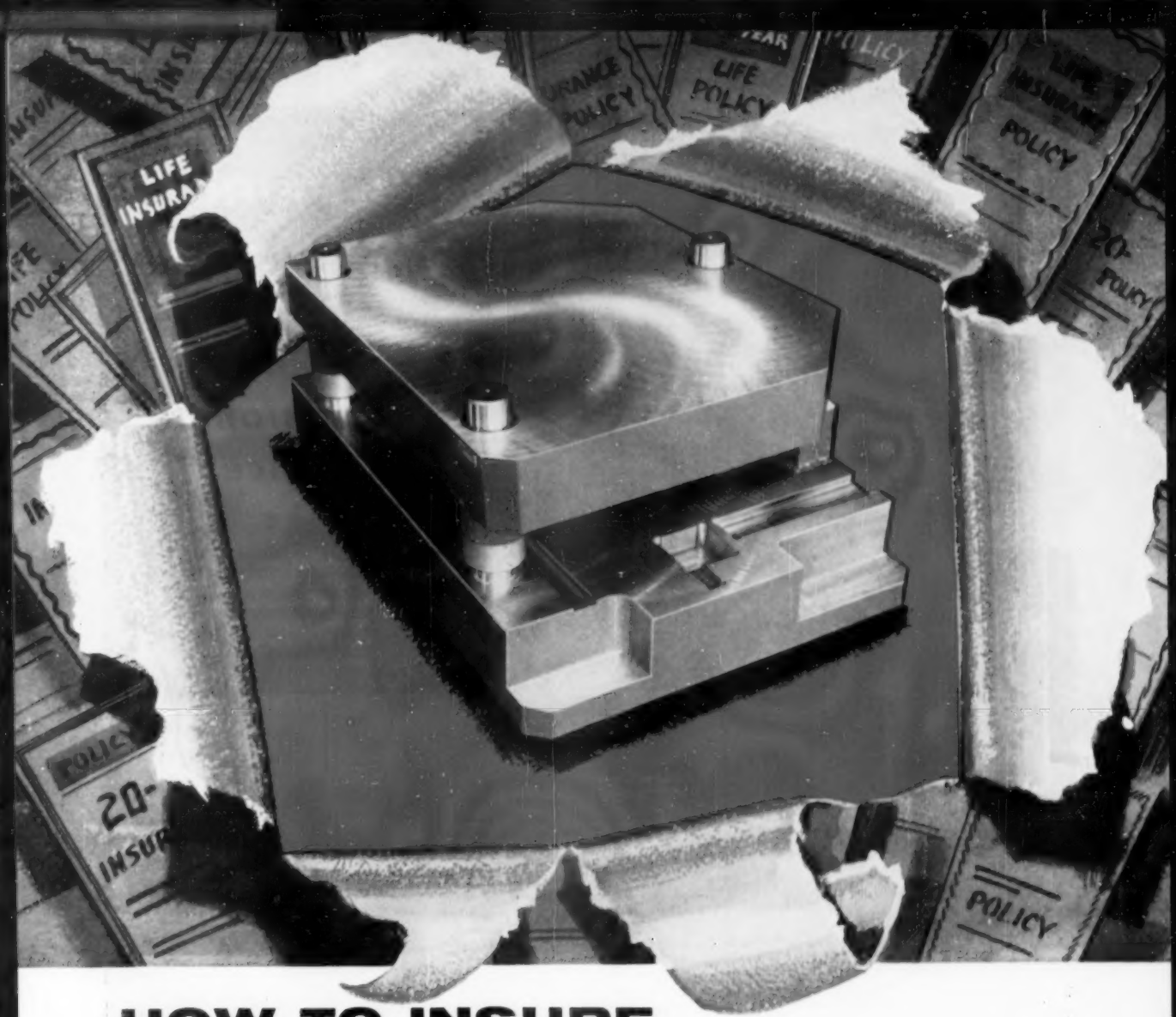
Working closely with the Osborn representative, he built the rotating fixture shown above. Three Osborn Master® Wheels quickly remove feather burrs, blend surface junctures. Uniformly finished parts come through at the rate of 1400 per hour.

Osborn offers its services to you without obligation. A qualified **O**sborn **B**rushing **A**nalyst is available wherever industry centers. He will welcome the opportunity to work with you. Write *The Osborn Manufacturing Company, Dept. k-36, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Write TODAY for the new 100-page Osborn Catalog 210-C.

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES



HOW TO INSURE YOUR COSTLY DIES . . .

DON'T buy "bargain-price" special die sets!

When you need a special die set it is usually for an expensive die . . . one that you really should protect.

The few dollars extra you may pay for a "Detroit-built" special are the cheapest insurance you can have that your costly die will get maximum protection.

Believe us—there is a lot more to a good special die set than some steel plate and a few pins and bushings.

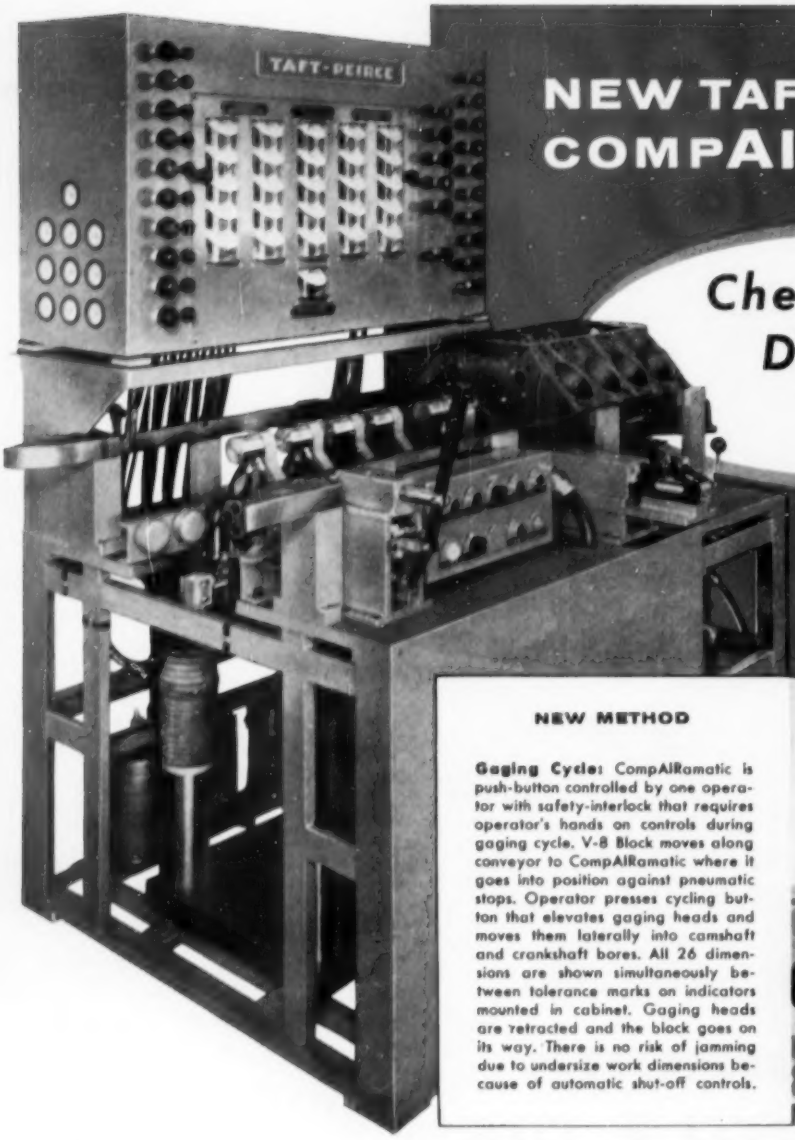
The protection your costly dies get from Detroit-built die sets is not accidental. It is built into every die set we make—standard or special—and we've been doing it for 30 years.

Sure, you can buy cheaper die sets, but they can be awfully expensive, too.

OFFICES IN PRINCIPAL INDUSTRIAL CENTERS

Detroit
DIE SET
CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICH.



NEW TAFT-PEIRCE COMPAIRAMATIC

Checks 26 Dimensions at once!

Air Gaging and workhandling combined for Push-Button Gaging Crankshaft and Camshaft Bores, and Presence of Oil Holes in V-8 Engine Blocks.

NEW METHOD

Gaging Cycle: CompAIRamatic is push-button controlled by one operator with safety-interlock that requires operator's hands on controls during gaging cycle. V-8 Block moves along conveyor to CompAIRamatic where it goes into position against pneumatic stops. Operator presses cycling button that elevates gaging heads and moves them laterally into camshaft and crankshaft bores. All 26 dimensions are shown simultaneously between tolerance marks on indicators mounted in cabinet. Gaging heads are retracted and the block goes on its way. There is no risk of jamming due to undersize work dimensions because of automatic shut-off controls.

OLD METHOD

Here is a semi-automatic air gaging unit that replaces multi-step, time consuming quality control with a single, low-cost operation.

Problem: Long, counterbalanced air plug gage on hoist had to be centered and inserted through camshaft bores by the operator. Another air plug gage was required for crankshaft bores, while another gaging method was used for checking presence of oil holes. Although gaging was accurate, the operation was inefficient and tiring for the operator.

Solution: Taft-Peirce developed this 26-dial CompAIRamatic that simultaneously indicates: 1. 5 cam bore diameters in two planes within .0015" total tolerance. 2. 5 crank bore diameters in two planes within .002" total tolerance. 3. Cam counterbore within .0005" total tolerance. 4. Presence of oil hole reservoir in 5 cam bores (using patented Taft-Peirce Comp-Utair Air Gaging Circuit).

Bring new cost savings to your quality control. Let Taft-Peirce help you engineer new air gaging concepts into your production line — from single dial units to multi-dial air-electric units for fully-automatic operations. Contact your nearest Taft-Peirce representative or write Taft-Peirce Manufacturing Company, Woonsocket, R. I.

Free Booklet "6 Special Ways to Air Gage For Lower Costs, Higher Production" shows typical T-P CompAIRamatic installations. Write for your copy.

TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MANUFACTURING CO., WOONSOCKET, R. I.

T-P Means TOP Precision

This Month's

GEAR PIX

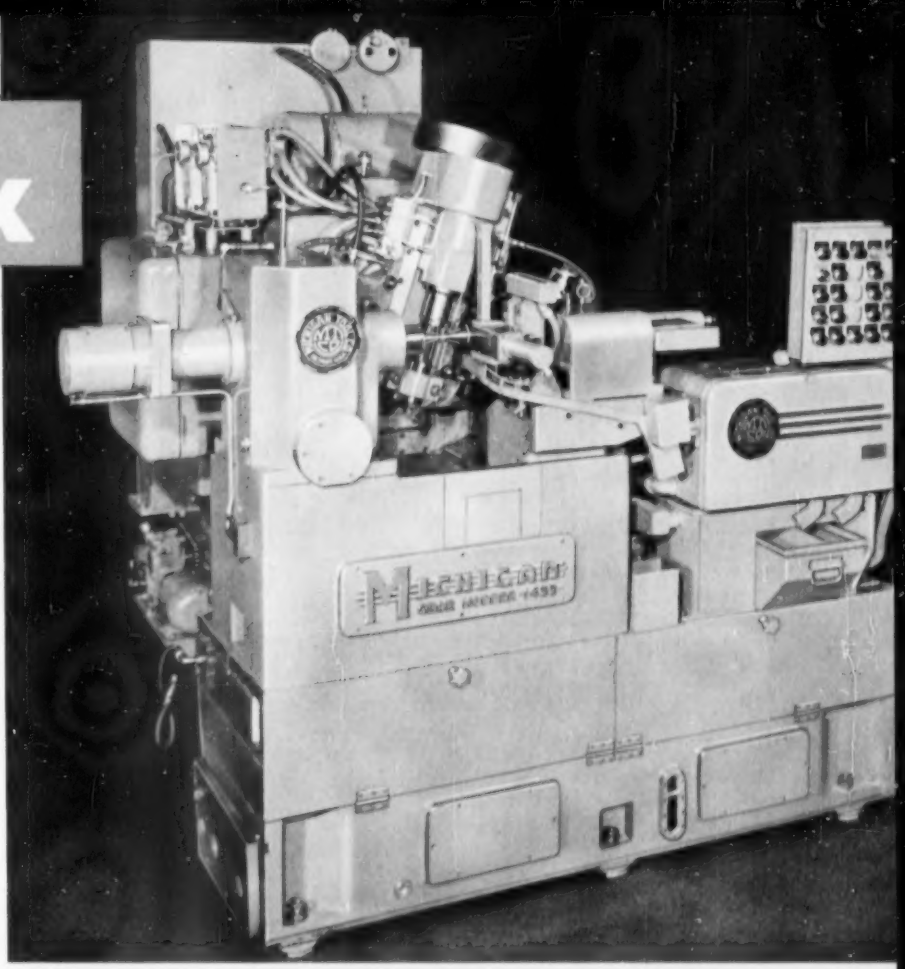
Announcing

A NEW HIGH-SPEED TANDEM

GEAR HOBBER

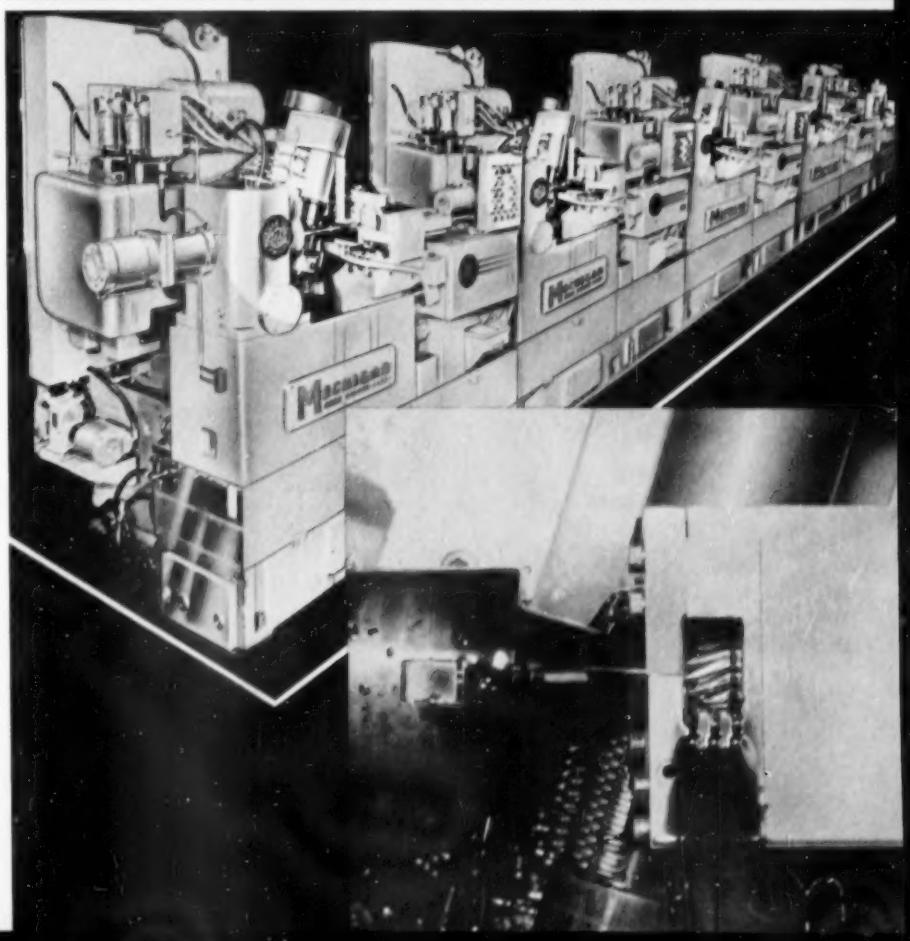
a new concept . . .

. . . supplies the answers to gear production problems. It's Michigan Tool's newest, the Tandem High-Speed gear hobber, Model 1433. A machine that can be set up in tandem or in-line series to tailor gear output to needs. The 1433 will precision hob spur gears up to 12 pitch or helical gears up to 30° helix. Center distance between hob arbor and work spindle is 3½ inches. Maximum crossfeed stroke is 4 inches.



. . . a new dimension

This new hobber lends itself to any degree of automation. Blanks may be supplied from an overhead distribution system. A common sub-base—in any length or configuration—provides parts removal from any number of machines. All machine services including the master panel and electrical connections are self-contained as part of the basic "building-block." Sub-bases are readily joined side by side to any length for any production rate.



. . . a proven principle

The 1433 single-spindle hobber features "plunge" or standard cutter feed, vernier-scale helix angle setting and an automatic expansion arbor for workholding. Set up is fast and simple. Hob speeds range up to 500 rpm—hob feed is infinitely variable. Automatic size control is also provided. Cut gears, automatically unloaded, are air-blast cleaned and automatically checked.

For complete information on Michigan's Tandem gear hobber, write for Bulletin TH-33.

MICHIGAN TOOL COMPANY

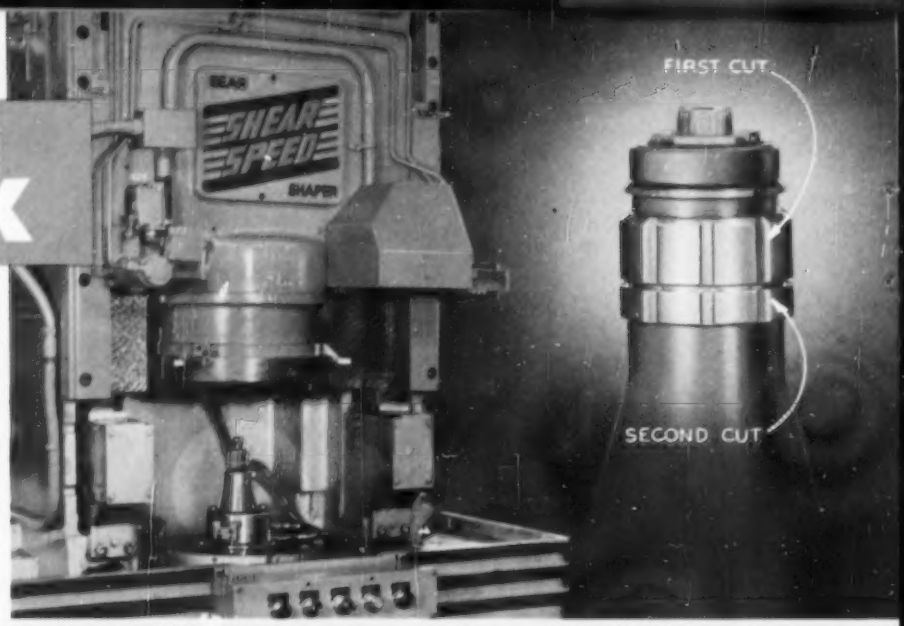
7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

This Month's

GEAR PIX

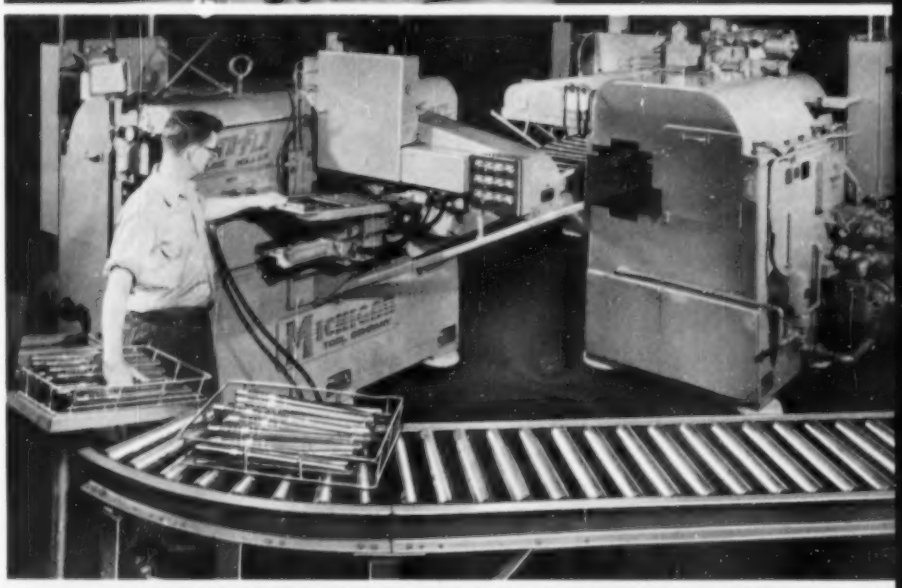
CUTS TWO PD's IN ONE SETUP WITH SAME TOOLS ▶

A new two-stage Shear-Speed gear shaper does the job if you have a part (such as a two-step clutch) requiring two different pitch diameters. It eliminates second setups. The two sets of teeth are cut in sequence (the deeper teeth first) with the machine cutting head locked in two different positions. Differential tool feed takes care of the PD's. Work cycle is automatic. All Shear-Speeds in the 1800 series can be so modified. We'll be glad to fill you in on details.



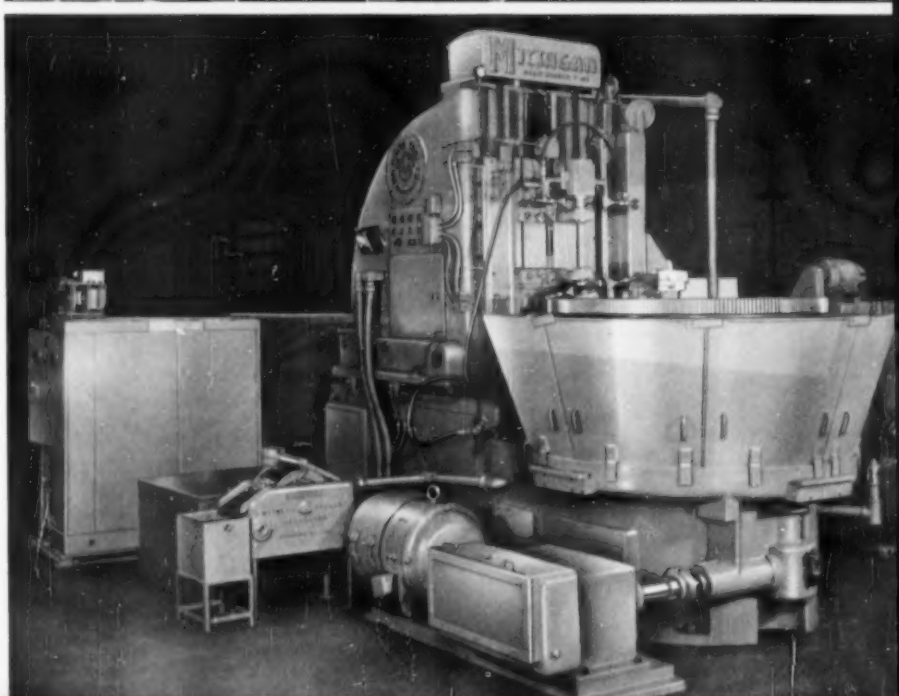
285 SHAFTS PER HR TRI-SPLINED BY "CHIPLESS MACHINING" ▶

Three different involute splines are cold formed on a transmission shaft in this trio of Michigan Roto-Flo machines. Transfer devices make the setup fully automatic after the first station. The method also offers long tool life and added product strength. More information is available in our Bulletin RF-55. Write for it.



HIGHER PERFORMANCE WITH IMPROVED GEAR SHAVER ▶

An improved Michigan Gear Shaver, Model V-48, cuts spur, spiral or herringbone gears up to 4 ft. P.D. It features full-range drive using only two sets of change gears and an integrated spiral pitch checker. Speeds and feeds are completely variable. Literature available soon.



MICHIGAN TOOL COMPANY

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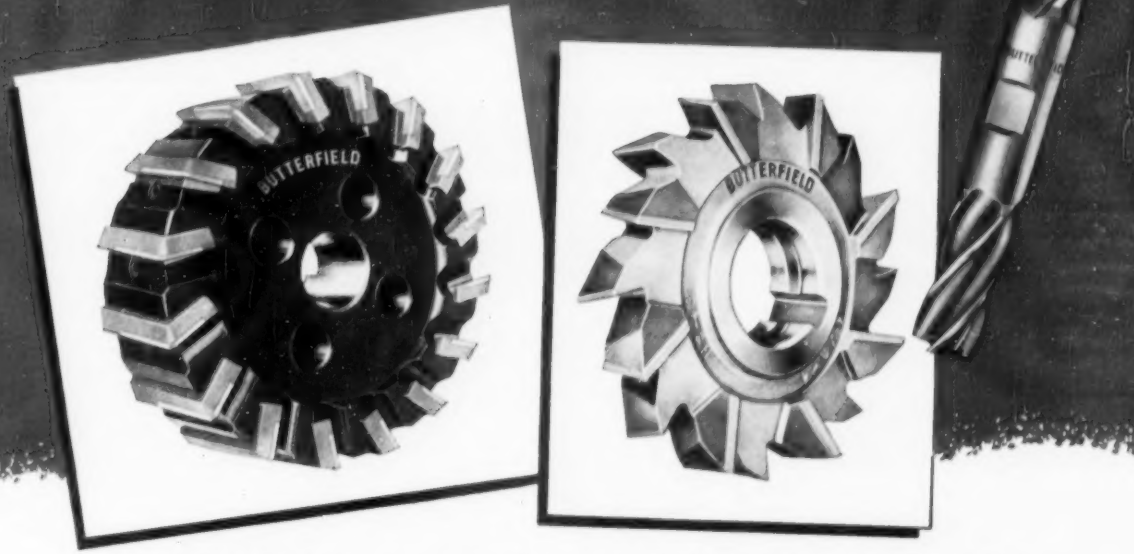
100%

BUTTERFIELD

Cutters and End Mills

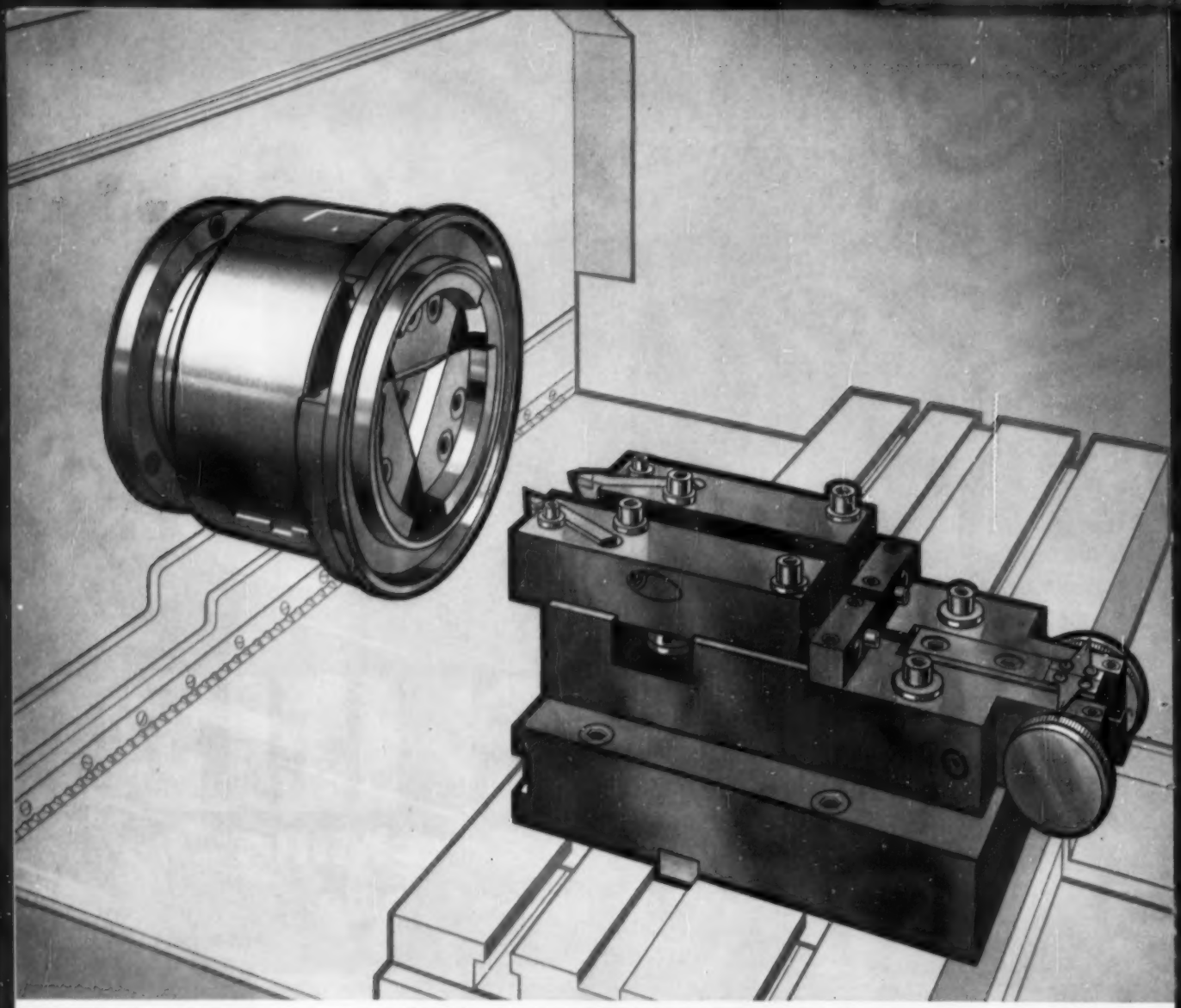
... high speed steel or carbide ...



100% COMPLETE LINE . . . EVERY TOOL 100% INSPECTED . . . AND YOU GET

100% SERVICE FROM YOUR BUTTERFIELD DISTRIBUTOR

Butterfield also offers a complete line of taps, dies, drills, reamers, hobs and carbide cutting tools. There are Butterfield warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York, San Francisco. **BUTTERFIELD DIVISION** • Union Twist Drill Company • Derby Line, Vermont.

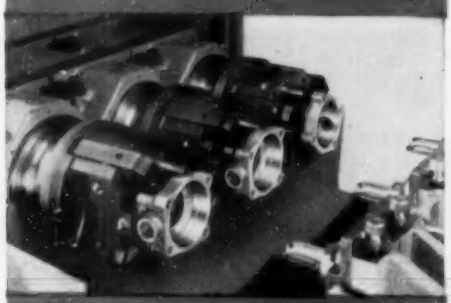


closer tolerances because of cam control

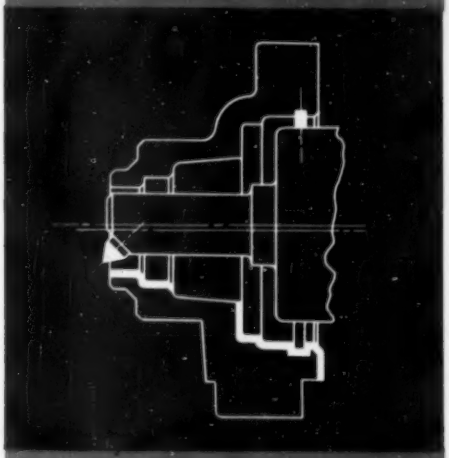
in New Britain precision boring machines

Every piece turned out by a New Britain Precision Boring Machine is accurate in every dimension because of the precision cams which control the slides. Tool wear can be checked by gauging a single dimension per tool of even the most complex contoured piece. There's no substitute for this positive uncomplicated dimensional control when you're working to "tenths." The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

Precision Boring Machine



Showing parts mounted in the chuck. Without chuck changes, any of three parts having different exterior forms but identical interior contours can be accommodated.



12 operations are performed in one machine cycle. Heavy lines denote surfaces machined.

Intricate contouring is fast, accurate—

12 operations in one cycle!

Direct cam action—no levers—provides Ex-Cell-O Precision Boring Machines with accuracy, versatility and speed in difficult contouring operations.

In the application shown here—contouring an internal form in die-cast aluminum end covers—limits on diameters are held as close as plus or minus .0005 inch, and three work pieces are completed at a time. 12 separate operations are performed in one machine cycle, including precision boring, facing, chamfering and grooving.

Cams can be changed in minutes. Cam assembly swings out for quick, easy change. All motors are outside the base.

Another Ex-Cell-O feature is the large chip chute, cast as an integral part of the base. There are no openings where chips or coolant can enter the base. Contact your Ex-Cell-O representative or write direct for complete information.

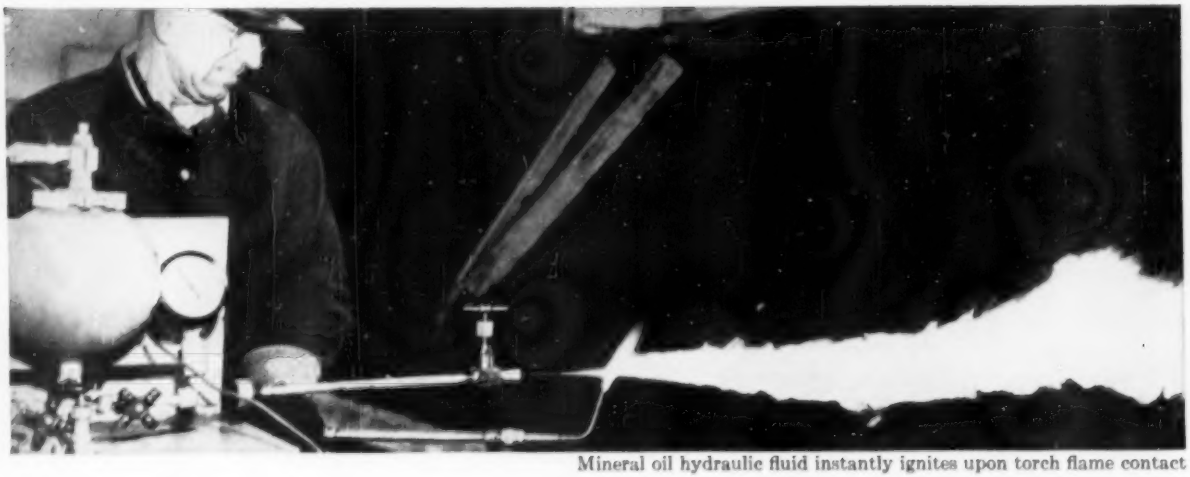
EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-62

XLO
EX-CELL-O FOR PRECISION

At left: The Ex-Cell-O Styled 312 Cam Operated Precision Boring Machine. A smaller model, the Ex-Cell-O Style 308, is also available because of the demand for this type of machine.



Mineral oil hydraulic fluid instantly ignites upon torch flame contact

Fire resistance plus low cost

For many years frequent industrial fires involving hydraulic fluids have taken their toll in man-hours and high costs. This has created a widespread need for a relatively inexpensive all-purpose, fire-resistant hydraulic fluid.

In undertaking this challenge, Shell Research Laboratories spent over four years in laboratory and field testing before a solution was reached. The result was the introduction of Irus* Fluid 902 . . . the first low-cost, oil-base fluid that, under plant conditions, actually snuffs out fire.

The new formulation is a specific combination of petroleum oils mixed with water and emulsifying agents. It gains its fire resistance through a relatively high water content. Irus Fluid is perfectly adapted to the majority of hydraulic systems. The following is typical of many reports in Shell files.

Typical Problem and Solution

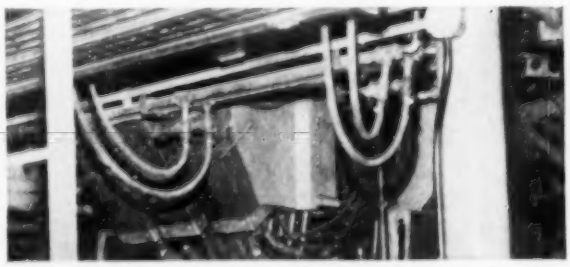
The welding plant of a prominent automotive manufacturer employing 100 hydraulically operated electric welders formerly used a straight mineral oil fluid. On one occasion, damaged fluid lines allowed this mineral oil under high pressure to spray directly onto the welding area. Sparks ignited the fluid . . . caused an immediate flash fire which resulted in 75% machinery damage before it was extinguished. Immediately following this incident, the changeover was made to Shell Irus Fluid 902. Shortly thereafter a line broke and the high-pressure spray once more contacted welding sparks. There was no fire at all . . . and in a matter of minutes the machinery was operating at full efficiency.

The two photos above provide dramatic proof of its flame resistance. In the photo on the left, conventional hydraulic fluid instantly ignites upon contact with an oxy-acetylene torch flame, whereas Shell Irus Fluid 902 (right photo), under the same conditions, does not support combustion beyond an inch or two from the flame. *Under plant conditions, it actually snuffs out fire!*

Two-Way Economy

An advantage not to be overlooked is the low cost of Irus Fluid 902. Many plant operators now making the

A leak is quickly spotted because of Irus Fluid's distinctive yellow color.



The complexity of cable lines necessitates the use of a fire-resistant hydraulic fluid to eliminate fire hazard.

Under the same conditions, Shell Irus Fluid 902 clearly demonstrates its fire resistance

in a new hydraulic fluid

switch to Irus Fluid find that it costs up to one-third less than other fire-resistant fluids—and its performance is comparable in every practical respect. This money-saving advantage is a vital consideration not only in the initial purchase price, but in reducing make-up loss expense.

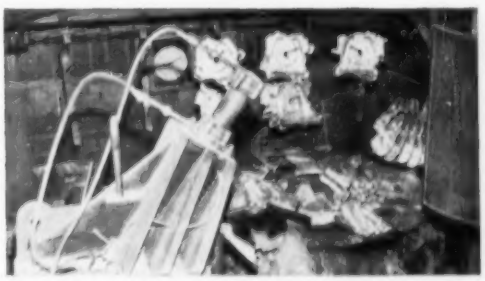
Irus Fluid 902 has other features, too:

1. **It contains no corrosive ingredients and has shown no harmful effects on normal seals, fittings, or bearings . . . it will not promote rust.**
2. **No major equipment modification is necessary . . . simply clean your present fluid thoroughly from the system and replace with Irus Fluid.**
3. **Practical application proves it has exceptional viscosity and lubricating qualities . . . doesn't thin out in use.**
4. **The yellow color of Irus Fluid enables you to spot and trace leaks easily . . . a valuable benefit in preventive maintenance.**

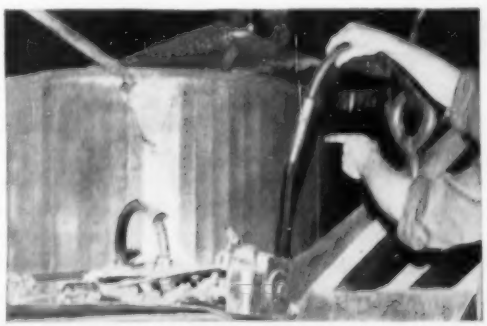
If your operation utilizes die-casting machines, plastic molding machines, glass blowing machines, permanent mold machines or any other hydraulic equipment where fire hazards are of concern, we suggest you investigate the advantages of Shell Irus Fluid 902.

Write or call the Shell Oil Company office nearest you.

*Trademark



Such specialized die-casting machines require a fire-resistant hydraulic fluid to assure maximum safety.



Finger points to line break in hydraulic cable that caused flash fire and machinery damage while operating with mineral oil type fluid.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 8, CALIFORNIA

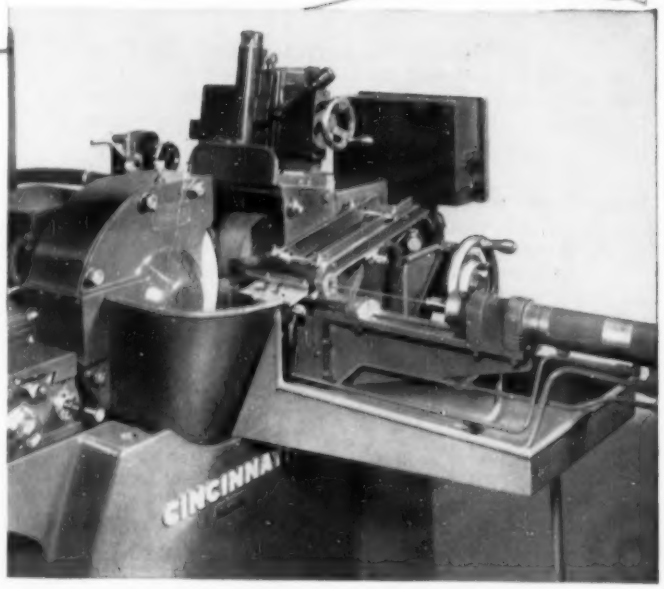
SHELL

Cincinnati Filmatic Nos. O·2·3·4·5·6 Centerless

The No. O is the machine for this job . . . grinding diameter and back taper on small drills

CINCINNATI

FILMATIC



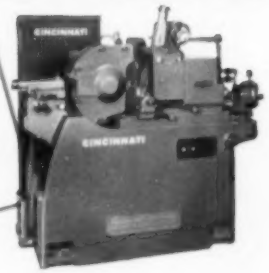
Low, low cost of machining operations is essential for competitive pricing of small drills ranging in size from No. 60 to ¼" diameter. One manufacturer does an excellent job by grinding the diameter and back taper on CINCINNATI® FILMATIC No. 0 Centerless Grinders.

The machine operates at a very high rate of production, grinding 16 drills per minute (768 per hour at 80% operating efficiency) to high standards of quality and at negligible cost.

You'll want to know why the No. 0 . . . one of six sizes of Cincinnati's line of standard Centerless Grinders . . . does such a fine job of grinding small parts. Spindle bearings are the exclusive FILMATIC type that never wear out; lubrication is automatic; regulating wheel speeds are infinitely variable; 5 hp drive; readily automated. Capacity: up to ½" diameter. Want more information? Look in Sweet's Machine Tool File, or write for a copy of catalog No. G-640-1.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI FILMATIC No. 0 CENTERLESS GRINDING MACHINE
CATALOG No. G-640-1



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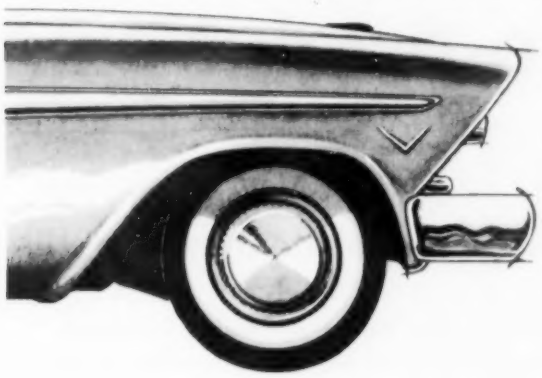
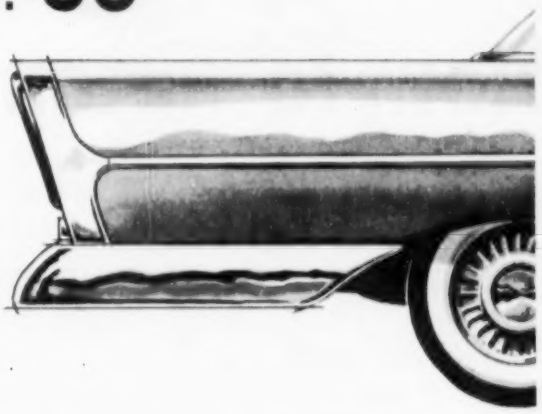
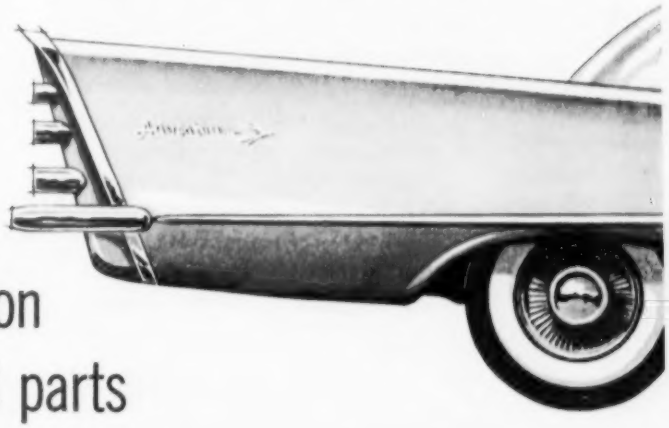
MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Oakite Composition No. **98**





Accepted by the automotive industry



for cleaning and temporary rust protection of in-process machined parts

A unique Oakite material No. 98 for spray washers appears on Approved Cleaning Material Lists for famous 1957 cars. It not only cleans gears, blocks, cylinder heads, transmission cases and other machined and ground metal surfaces but also protects them against rust until assembly. What Oakite 98 does for auto makers it can do for you.

Performance of Oakite Composition No. 98 stands out for a *combination* of reasons:

- **It clears away heavy soils at up to 180°F. but will also do light cleaning at room temperature**
- **It removes even metal chips**
- **The streak-free residual protective film it leaves upon drying doesn't interfere with gauging at inspection**

Oakite Composition No. 98 has proved it can help maintain the automotive industry's high standards of efficiency in manufacturing. If your plant does spray cleaning, it offers you these benefits and economy too, both from the standpoint of usage and upkeep. It is being used in 1, 2, or 3-stage machines at ½% to 2% concentrations. For more information, write Oakite Products, Inc., 38H Rector Street, New York 6, N. Y.

OAKITE

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SCIENCE

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Technical Service Representatives in Principal Cities of U. S. and Canada

A Multipress case study

How to automate production

Multipress® curbs costs of Dormeyer mixer parts . . . triples output by integrating three separate operations

Often, a series of operations can be combined to both improve product quality and cut production costs. This was the experience of Haber Corp. when they streamlined production of beater spindles for their Dormeyer automatic food mixers.

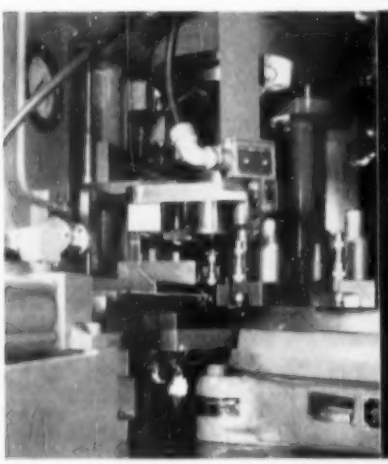
By reducing the size variations of slots cut into the spindles and thus eliminating the need for deburring, quality was boosted . . . costs cut.

A special 8-ton hydraulic Multipress was selected to combine three machining operations. Only loading parts on the 12-station hydraulic index table is performed manually. Once the cycle-start button is pressed, the parts advance step-by-step until a small flange-mounted cylinder ejects the finished beater spindles.

In separate manual operations, production rates of from 200 per hour for cutting slots to 450 per hour for deburring had been standard. With Multipress, a continuous flow of 1020 beater spindles per hour is achieved with only one operator.

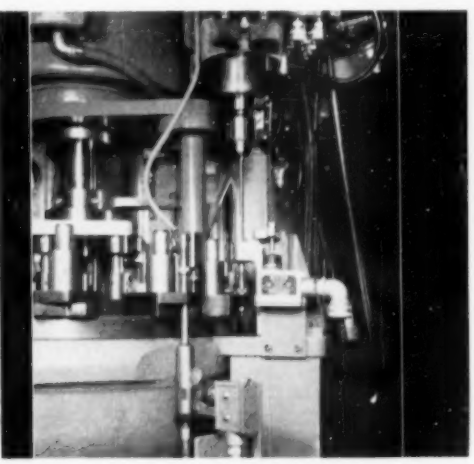
Advance cost analysis estimated that equipment and tooling would be amortized within a year due to increased production and quality. Actual production proved this estimate too conservative.

Find out how Denison hydraulic Multipress can perform a three-in-one job for your company—improving quality, speeding production and cutting costs. Write to Denison Engineering Division, American Brake Shoe Co., 1182 Dublin Road, Columbus 16, Ohio.



Ram descends to shear four slots, then holds down under full pressure as side cylinder advances broach for .050 slot. Chips are trimmed at next ram station.

Next, spindle receives hopper-fed sleeve under transfer mechanism. Sleeve is pressed over spindle end by a cylinder activated by descending ram.



In final operation, spindle is clamped and center hole reamed through by drill head. Flange-mounted cylinder then ejects spindle from fixture.

hydraulically

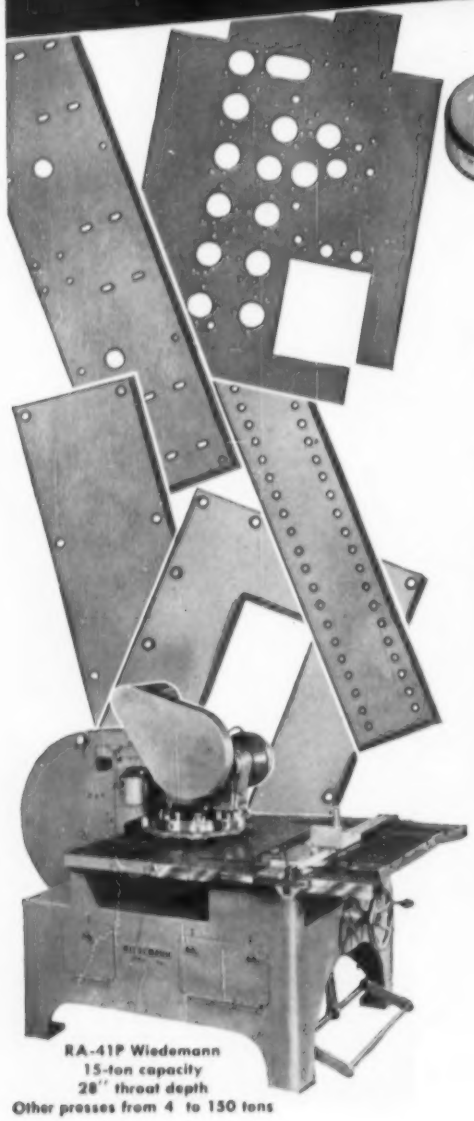
8-ton hydraulic Multipress equipped with 12-station index table. Index table is mounted over special bolster on 22-inch work circle, to which is attached one-ton capacity, foot mounted hydraulic cylinder with 12-inch stroke.

Various machining stages illustrated: (left to right) spindle prior to slotting; after shearing slots, showing chips; after trimming of slots; with sleeve pressed into place.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON HydrOILics

Versatile WIEDEMANN TOOLING *Saves You Money*



RA-41P Wiedemann
15-ton capacity
28" throat depth
Other presses from 4 to 150 tons

6 typical jobs—total cost of tools shown . . . $194.80! That's just the first of many cost-saving advantages of piercing short run jobs with a Wiedemann Turret Punch Press.

Hundreds of Wiedemann users report 60% to 90% direct savings in production of chassis, panels, side rails, etc. —and engineering changes are reduced to a matter of minutes.

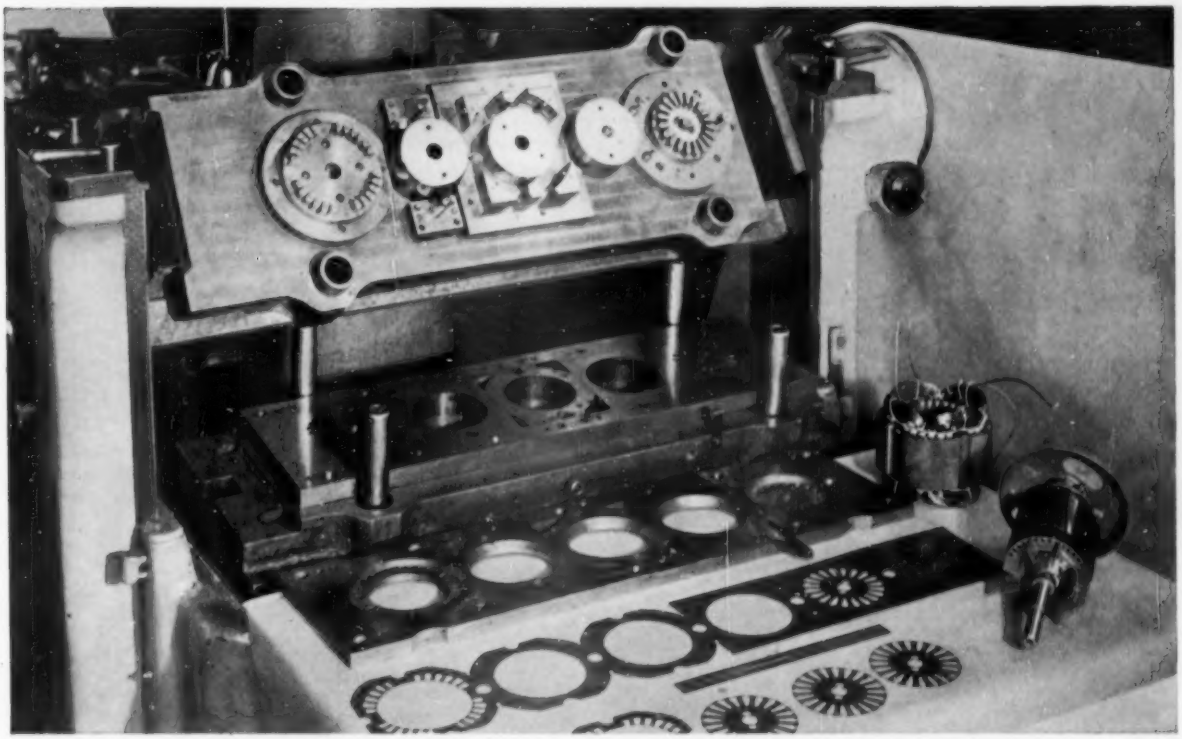
Wiedemann Turret Punch Presses require only one punch and die of a size . . . rounds, squares, louvers, groups, extrusions . . . from 0.093" dia. to 7" square and each is ready for use . . . larger openings and notches are produced easily with a series of "hits". Here is real low-cost tooling flexibility.

Why not prove to yourself how much more you could produce for *less* with a Wiedemann. We'll be glad to make a time study of your work. Just send prints and ask for Bulletin 201.

There's a Wiedemann
for every short run piercing requirement.

WIEDEMANN
MACHINE COMPANY

4245 Wissahickon Ave. • Philadelphia 32, Pa.



LIFE magazine selected the Ehrhardt punch and die above to illustrate the Special Feature Series on AMERICA'S ARTS AND SKILLS, Part IX: Beauty in the Tools of Today.

This Ehrhardt die appeared in LIFE magazine ...and here is its "life story"

When a die—even an Ehrhardt die—wins a "beauty rating" in LIFE—that's news. But there's more to *this* success story—*triple plus* tells you how Ehrhardt brought the first precision tooling to the Mississippi—then grew at a rate startling to skeptics in the industry.

The above multi-stage lamination die produces rotors and stators for air conditioning equipment motors. Its complete punch alignment was checked without removing it from this Moore "die Flipper"—one of a complete battery of special machines which guard Ehrhardt's famous precision at each step, and include the latest Elox electrical discharge machining equipment.

If your own tooling ideas encompass even higher orders of precision—if you, too, foresee laboratory exactness soon being demanded routinely—if you'd rather be prepared for tomorrow than caught with your tolerances down—read *triple plus* and be ready.

Ehrhardt/St. Louis accepts and solves problems at a level of difficulty declined by all but an estimated handful of shops in the United States.

Send for the booklet *triple plus* today. Learn how this Ehrhardt concept—full range facilities, plus precision skills, plus unique experience—can add up to a profit story for you.

EHRHARDT TOOL & MACHINE CO., 914 Monroe Street, St. Louis 6, Missouri
Telephone: CEntral 1-5350

A nation-wide service to the few who want the most in high precision gages, dies, jigs and fixtures

Ehrhardt/St. Louis

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Please send me a copy of **triple plus**

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COMPANY _____

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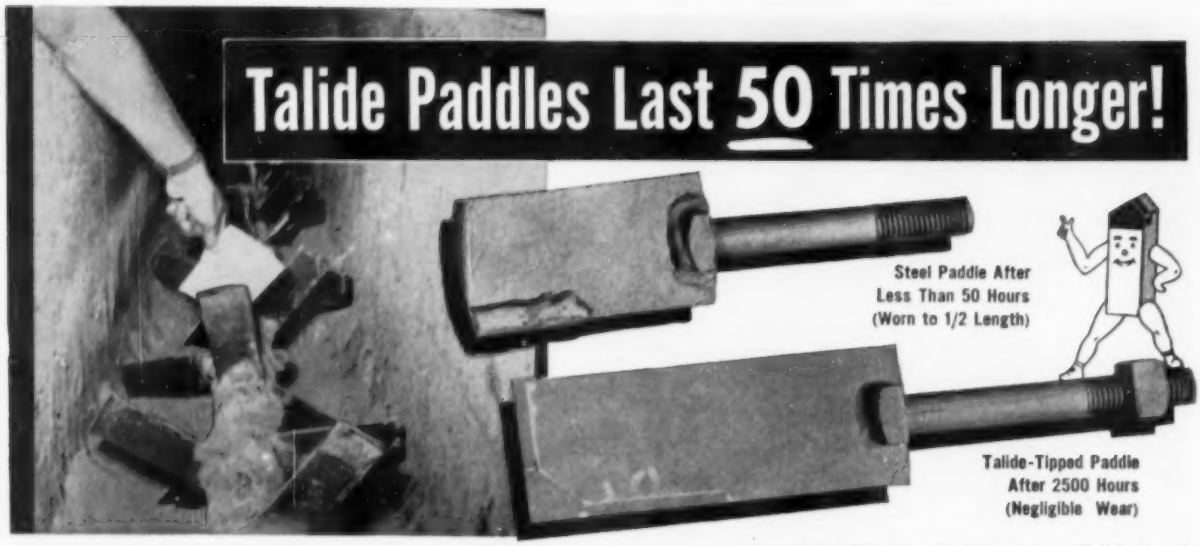
Talide Paddles Last 50 Times Longer!



HARDEST MAN-MADE METAL!

TALIDE METAL, a tungsten carbide of superior quality, is harder, stronger, and more resistant to abrasion than any other metal. Properly applied, it gives superior service on applications where wear, heat, strain, and shock are destructive to other metals.

- **ABRASION RESISTANCE**— Up to 100 times that of steel.
- **COMPRESSIVE STRENGTH**— Higher than all melted, cast or forged metals and alloys.
- **RESISTANCE TO DEFORMATION**— 2 to 3 times greater than steel.
- **HEAT RESISTANCE**— Resists oxidation and thermal shock up to 1500° F.
- **THERMAL EXPANSION**— Less than half the rate of steel, "creep" is negligible.
- **FRICTIONAL RESISTANCE**— Lower than steel, non-galling, "slippery" properties higher.

ALL TALIDE METAL grades are made in latest type vacuum electric furnaces by precision methods under rigid control. A wide variety of shapes and sizes can be supplied—up to 25" in diameter, 100" in length, and 5000 pounds by weight. Parts can be supplied to any grit finish required down to one micro-inch. The physical properties of the most commonly used grades are listed below. Other grades are available for specialized applications.

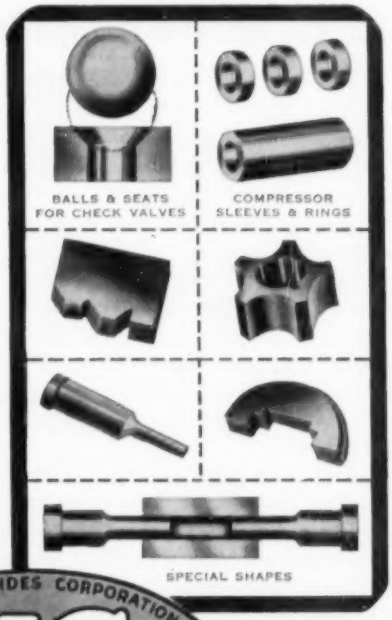
PHYSICAL PROPERTIES OF TALIDE METAL (P. S. I.)

Application	Operation	Talide Grade	Rockwell "A" Hardness	Specific Gravity (Density)	Transverse Rupture Strength	Compressive Strength	Co-Efficient of Thermal Expansion	Modulus of Elasticity (Deflection)
WEAR SURFACE	No Shock	C-91	91.8	14.90	235,000	710,000	3.00x10-6	91,000,000
	Light Shock	C-99	91.0	14.75	265,000	670,000	3.65x10-6	84,000,000
	Medium Shock	C-88	89.5	14.55	295,000	635,000	4.00x10-6	80,000,000
IMPACT	Light	C-85	88.4	14.25	315,000	600,000	3.75x10-6	77,000,000
	Medium	C-80	87.0	13.85	335,000	550,000	4.50x10-6	74,000,000
	Heavy	C-75	85.0	13.15	355,000	500,000	5.00x10-6	70,000,000

Note: Hardness values may vary plus or minus .2 to .3 on individual lots.

Leading brick manufacturer reports Talide-tipped pug mill paddles have outlasted 50 sets of hard-faced steel paddles to date—and are still in use. Operation involves mixing abrasive ceramic, clay and brick compositions.

TALIDE METAL is saving industry millions of dollars annually by wear-proofing vital parts on machine tools, presses, pumps, compressors and other types of processing equipment used in the steel, oil, chemical, plastic, auto, rubber, textile, glass, ceramic, mining and metalworking industry.



Send for new 76-page catalog 56-G or ask for sales engineer to call.

Metal Carbides Corporation
Youngstown 12, Ohio

More than 10 times taller

than the Washington Monument:

if one of each size in stock was placed end to end, of

acme bushings

- Only ACME offers you *TWO* standards: A.S.A. and ACME—#80 to 2".
- Standard sizes from your local distributor's stock—special sizes on request.
- Standard catalog tolerances.
- FREE catalog and price list.

Write your distributor or Acme for information and prices on micro, standard and tungsten carbide drill jig bushings.

ACME INDUSTRIAL COMPANY

208 N. Laflin Street • Chicago 7, Illinois • MOnroe 6-4122

Let's Face It

You don't have to be a top executive to recognize the competition faced by American industry. Even without visiting industrial shows abroad, you know of the rapid progress of European manufacturers. They are selling high-quality products throughout the world.

Let's face this challenge. Even though we have higher wage rates and more fringe benefits for our labor force, tool engineering ingenuity is equal to the task of producing more goods for more people at less cost. We can make products that are necessary for our high standard of living and that can compete in world markets.

Those who do visit foreign exhibitions, or read of them in the trade press, cannot help but reappraise their own product costs and quality. Meeting competitions falls more and more in the province of the tool engineer because big savings can be made in production. To meet or beat product quality at lower cost, tool engineers have to review materials, methods, processes and tooling. In some instances, production equipment will have to be rebuilt or replaced. Here again is a chance for ingenuity.

As a tool engineer, you have a wealth of information on production techniques to use as a starting point. Rather than worrying about European competition, you should welcome it. You can get ideas from your competitors and you will be stimulated into making your best effort. By constantly screening the ideas that have gone into new methods and proceses, and by reading technical publications, you will be in a position to successfully face the challenge of competition.

H E Collins

PRESIDENT

QUALITY CONTROL REPORT

These sparks reveal vital facts about quality control of steel

You are naturally interested in the quality of your finished products—and if you use steel in making them, you should know about the Ryerson quality controls symbolized by this spark test.

Here a skilled Ryerson inspector is checking the carbon content of a steel bar by "reading" the sparks thrown off by an abrasive wheel. It's an amazingly accurate method of making sure that you get exactly the steel you order.

And this is only one of many rigid quality controls that protect you in every purchase of steel from Ryerson stocks. For example, a heat symbol identifies every bar of alloy steel to avoid the problem of variation from heat to heat. Another example: cylinder tubing can be furnished to more accurate inside diameter through Ryerson specs controlling O. D. and I. D. instead of O. D. and wall.

The result: steel of certified quality—assured by exacting Ryerson controls, whether your product calls for carbon, alloy or stainless steels. And these quality controls become *your* quality controls in your finished product.

These are important points to remember when you specify or purchase steel. You get extra value every time you order from your nearby Ryerson plant.

RYERSON STEEL

In stock: Carbon, alloy and stainless steel—bars, structurals, plates, sheets, tubing, industrial plastics, machinery & tools, etc.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE • CINCINNATI CLEVELAND • DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

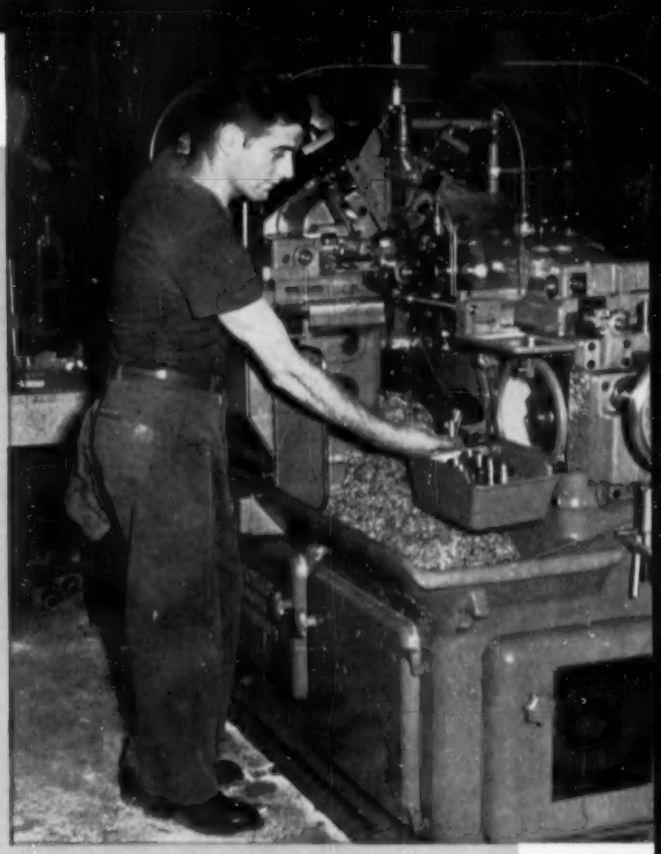


Fig. 1. Screw machine department at Argus Cameras, Inc. contains machines of various sizes and ages, making efficient scheduling complex.

MAKE or BUY?—find the answer with OR

By Ralph H. Eshelman
Associate Editor

Much has been heard about operations research, in general, but little about specific uses. This article describes a practical program of a medium-sized manufacturer. Scientific methods are applied to the difficult decisions of which parts are best to make and which to buy.

ONE OF THE MOST PERSISTENT problems that plagues the management of a manufacturing organization is how to decide which parts or components to purchase and which to make within the plant. Finding the proper answers has an important bearing on costs of the end product and on a firm's profit margin as well. In fact, a company's competitive position may well depend upon how these problems are solved.

Seeing possibilities in improvements in this area, Argus Cameras, Ann Arbor, Mich., now a division of Sylvania Electric Products, Inc., some time ago began investigating the application of operations research (OR) to the entire production planning and scheduling function. While the plant was operating smoothly and the in-process inventory seemed to be about normal, it was felt that a better coordination of the various departments of the company might be possible and would prove worth while. The management also wanted an external review to help establish

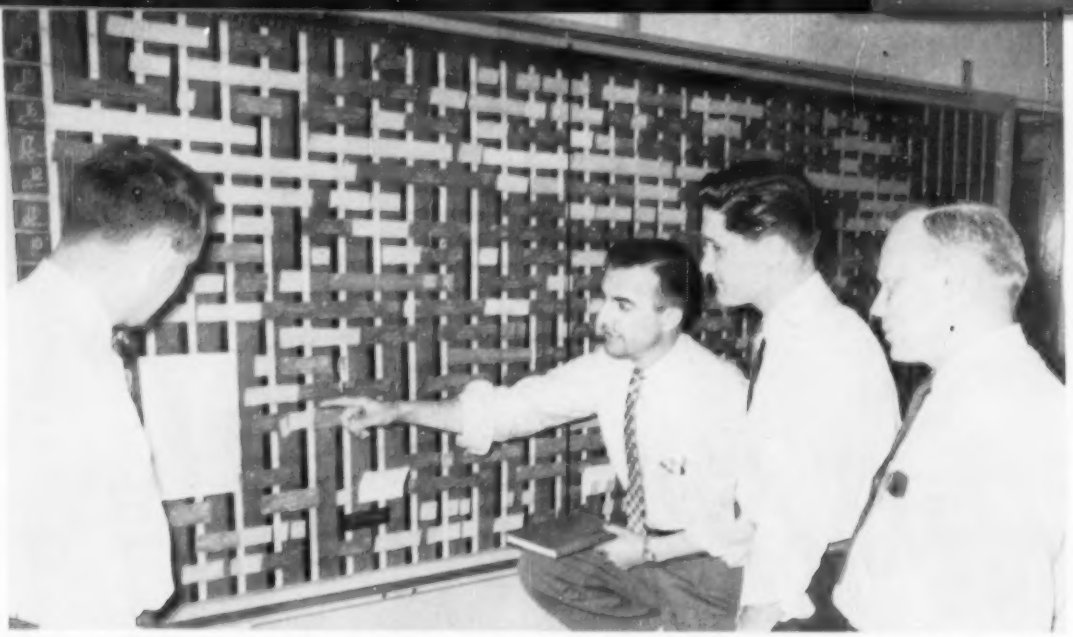


Fig. 2. Application of operations research includes use of models such as production scheduling chart.

concrete goals and standards of performance.

To this end an outside consulting firm was brought into the picture. The consultant was selected on the basis of having experience with operations research techniques and manufacturing problems, including those having to do with planning and scheduling. Since Argus produces consumer products which have seasonal and widely fluctuating sales, namely cameras, projectors and accessories, one of the continuing problems is to level out production peaks and valleys. At that time about 1000 employees manned the company's extensive glass grinding and polishing facilities and complete machine shop and finishing areas. Of some 1200 parts used in its products, many small parts require precision within a few ten thousandths inch.

Vendors are used extensively to supply many parts and components. These include not only standard items and parts for which there are no company facilities, but also high production parts such as stampings and screw machine parts. In this way it is possible to maintain less capacity than that needed for maximum requirements. Because of this policy of farming out parts in times of peak production and bringing them back into the plant when requirements drop, the purchase-or-make decision is an important factor in stabilizing employment. It also serves to keep plant operations competitive.

Particularly critical areas of production are the screw machine department, *Fig.* 1, and the press-room. In both of these areas ingenuity of tooling often spells the difference between success and failure. Argus is especially well-equipped in this regard, both in tool engineering and in the toolroom. To make the most of company resources, however, an accurate method of determining the appropriate parts to make and those to buy was needed.

As applied in this situation, operations research was conceived as simply the analytical search by a group of people with diverse backgrounds and qualifications to find an answer to a problem, *Fig.* 2. One of the first steps in the program was to train the company organization from top to bottom to think in terms of operations research. This was accomplished in several ways. Top management took part in several briefing and orientation luncheons. Middle management people who were involved in the program received instruction in evening sessions. Personnel selected to serve as team members met half days for concentrated training sessions away from the plant.

Once the OR team was selected and trained their first step was to begin collecting applicable data. To find a record of manufacturing costs they turned to the accounting department. There they discovered that standard cost procedures failed to provide the information in the form desired. Comparative data showing how much each part cost to produce was lacking. Further, in order to obtain a fair and accurate basis for comparison, it was felt that costs assigned both purchased and in-plant parts would need to be re-examined carefully.

For instance, it was concluded that an attempt to divide and apply the conventional overhead burden to individual piece-parts would serve no purpose. Instead, costs were classified somewhat differently, under a number of heads. Under fixed costs were placed in-line supervision, factory management and occupancy. In general, fixed costs include the charges of doing business and the services that must be maintained with little or no change over a rather wide range of production.

Another type of cost is that which occurs only once in an operation. Machine setup costs, for example, would fit under this head. This charge is the same regardless of the number of pieces pro-

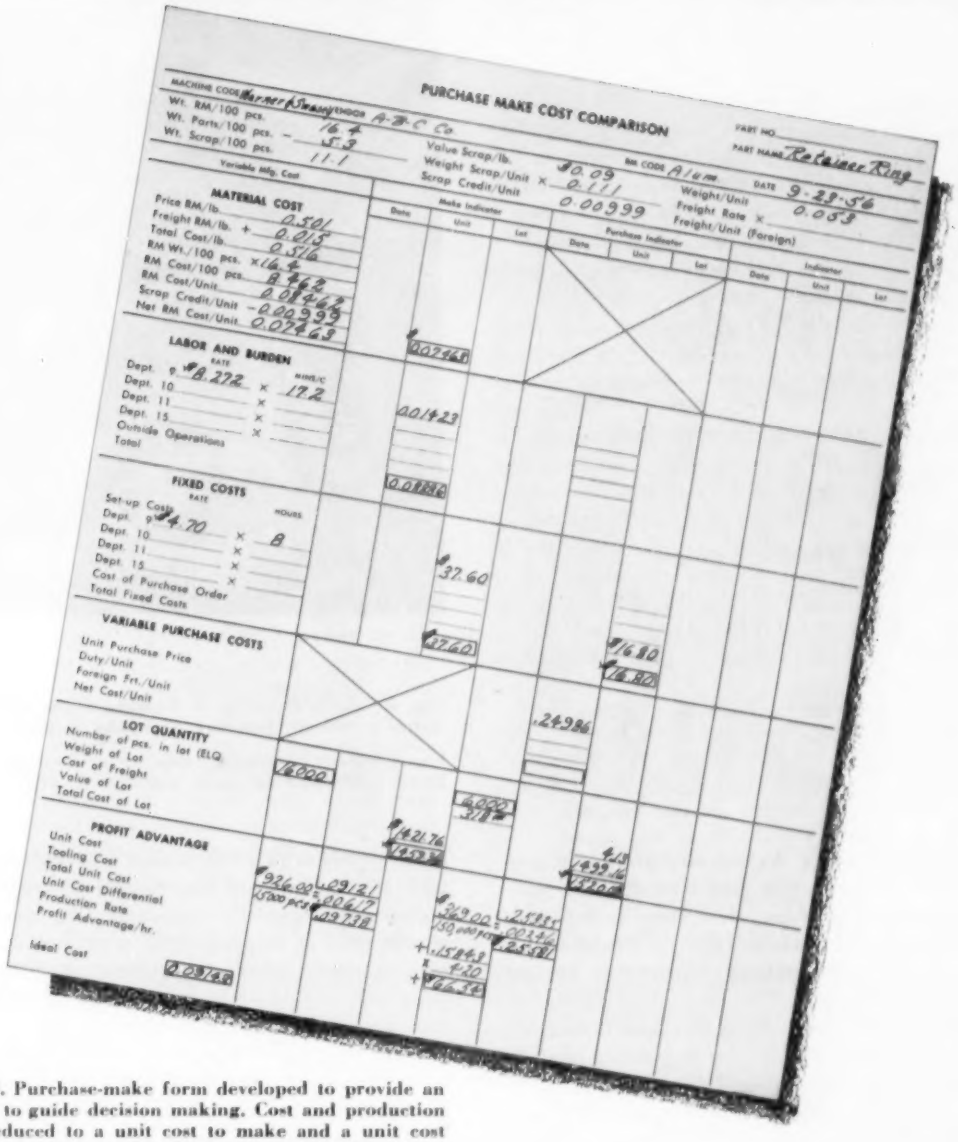


Fig. 3. Purchase-make form developed to provide an index to guide decision making. Cost and production are reduced to a unit cost to make and a unit cost to buy, and a profit advantage per hour's output.

duced in the lot. Under variable costs are placed those which fluctuate with the number of pieces produced. In this group are material costs, labor and machine maintenance.

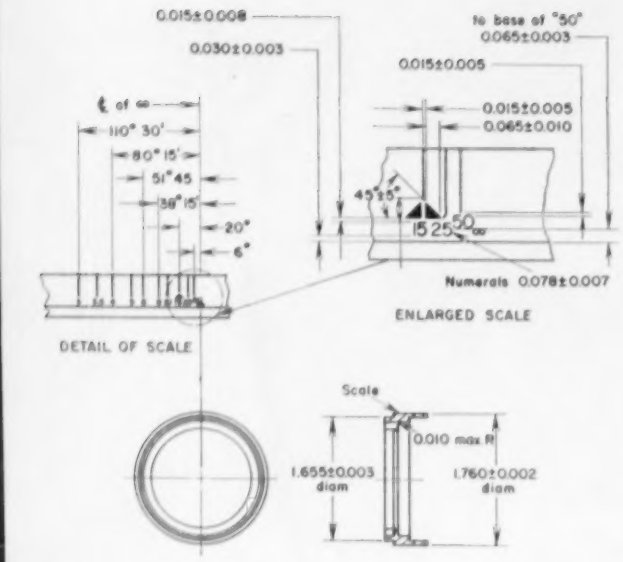
It was logical to eliminate from consideration those costs which were not directly concerned with fabrication of the individual part. This automatically excluded assembly departments, glass processing and most of the administrative costs of the company.

Burden costs included the operation of the purchasing department. This department was involved when the part was either procured through an outside vendor or when it was made in the plant, in the latter instance through purchase of raw materials and supplies.

To allocate these costs, detailed records were kept over a period of time until they could be assigned specifically. Numbers and types of purchase orders placed each month were recorded as well as the number of orders per month by type of material. This gave data which were directly applicable to purchase parts and fabricated parts. Operating costs of the tabulating department were likewise distributed, as well as accounts payable, production planning and timekeeping. Clerical work in inventory control was analyzed and allocated. Manual and clerical work in the receiving department was assigned on a percent of total man-hours in the department, as used by the departments concerned.

Costs of production engineering, industrial engineering, quality control and raw inspection were analyzed by means of historical records, the department head's judgment or other available records.

These studies yielded data satisfactory for the intended purpose. The system might be termed



Note: All diameters must be concentric with 1.5895 diam within 0.004 TIR

Fig. 4. (left) Drawing of focusing scale, which requires a difficult lettering operation as shown.

Fig. 5. (above) Lettering operation on focusing scale, being performed on screw machine in Argus plant.

partial direct costing. As indicated previously, general fixed charges, which were a result of the company's being in business, were omitted, but other items which would have an effect on purchase costs of a part or on the fabrication cost of an in-plant part were included.

Meanwhile a procedure was developed to continue gathering of these data, so that they would improve in accuracy as time went on. This responsibility was assumed by the accounting department. To keep the basic data on which the purchase-make decisions are made up-to-date, they are revised at least once a year.

Data are organized and focused on the decision to be arrived at for individual parts by means of a special form which was developed for the purpose, *Fig.* 3. With this it is possible to determine the unit price for making a part in the plant, the comparative price to purchase the same item, and finally the difference. The difference in the unit cost price is multiplied by the hourly production rate to get the profit advantage per hour. If this is a positive figure, it is more advantageous for the company to make the part. If the figure is negative, it is more advantageous to purchase the part on the outside.

Thus the operations research study has provided the company with a reliable numerical basis for making decisions on when to make and when to buy specific parts. Frequently, of course, there are other factors besides price alone which have an important bearing on such decisions. To continue the common-sense approach this OR project has developed, a team or committee has been formed to weigh these decisions as impartially as possible. The committee is comprised of representatives of production planning, quality control, engineering, methods and standards, cost accounting, mechanical processing, and purchasing department.

This procedure is in striking contrast to the way in which such decisions were often arrived at before the application of operations research techniques. Formerly, when a production bottleneck developed, perhaps with a screw machine part that could be produced on only one machine, the production control manager would get together with the foreman and the buyer. In the supercharged atmosphere that is typical of such situations they would hammer out an emergency decision, with no one very happy over the results.

In general, all stamping and screw machine parts, except standard hardware, are now within jurisdiction of the committee. Some parts, however, naturally fall either in the buy or make category. Some of the reasons would be as follows:

1. The company does not have facilities to make the part. It might require special equipment such as for a forging or deep drawn stamping
2. The company could not manufacture the part in economic quantities
3. Vendors refuse to quote on the part. This might be because of tooling, tolerances, quantity, some special requirement, etc.

4. Vendors have failed to meet tolerances or quality requirements so that prohibitive expense and inconvenience have resulted.

Since the purchase-make problems are primarily in the areas of screw machine parts and stampings, tooling often is a major factor in a decision. Typical of such cases is the focusing scale, *Fig.* 4. The analysis of this part showed a potential saving of $0.10 by making this part in the plant. Because many parts might show a much greater saving, this factor alone would be insufficient to swing the decision. Contacts with vendors, however, disclosed considerable uncertainty of the best method for putting the lettering on the part. When consulted, the tool engineers recommended that the company buy a roll-letter stamp and experiment with the lettering operation before deciding whether to go ahead with the complete tooling.

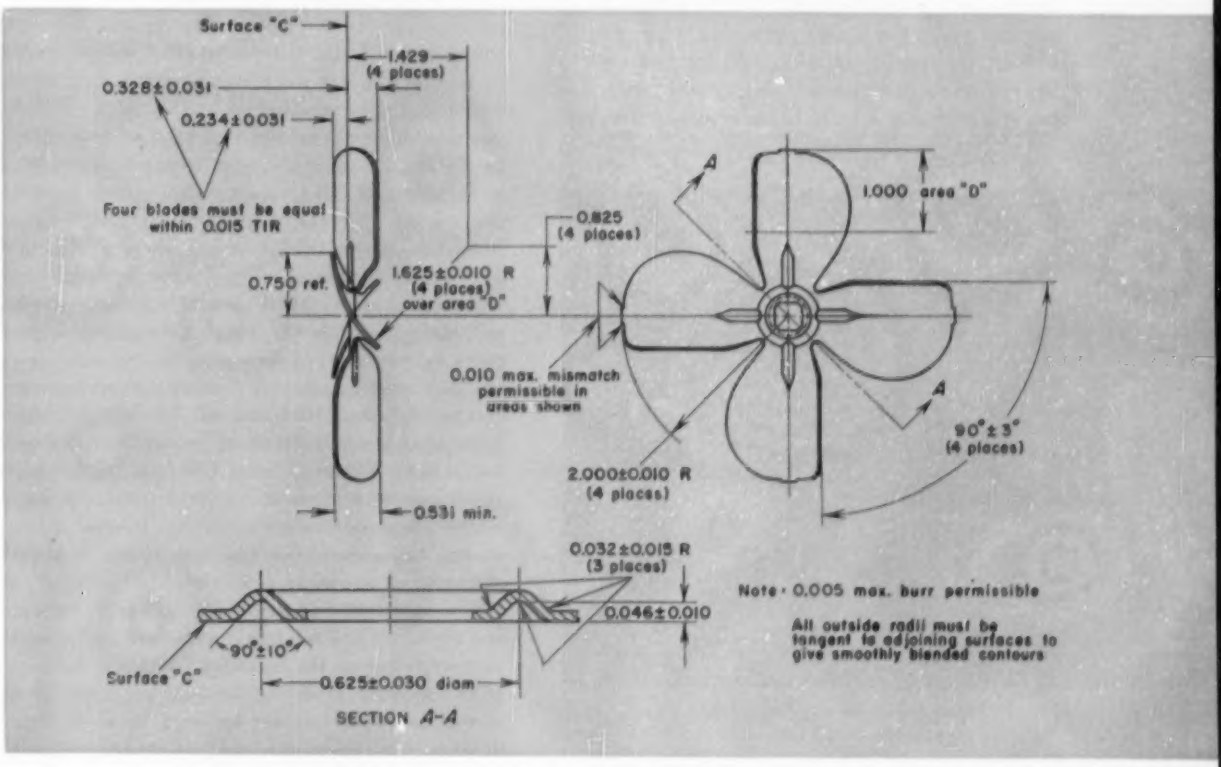
After some preliminary development work the tool design department devised an economical method of lettering the part, *Fig.* 5. This resulted in a saving per piece-part of $0.15, substantially more than was anticipated. The practical gain to the company may be even greater. From past experience it has been learned that when a vendor anticipates difficulty with a part, often the source may prove unreliable and problems of scheduling result.

While many of the committee decisions are strictly a matter of common sense, the members each have specialized responsibilities. In actual cost analysis, the quality control representative is responsible for determining the ability of a vendor or the company to meet specifications. The purchasing representative is responsible for determining whether the vendor can provide good service. Engineering and manufacturing representatives are concerned with tooling factors and probable obsolescence of the parts being considered. They also investigate to determine why the company is not competitive on appropriate parts, and what can be done to change the situation.

Complete data are provided the committee members previous to the meetings so that they can be familiar with pertinent information. In the meetings the decision process is simply one of applying group judgment and reasoning, bringing to bear the background experience of the various members. Some case histories of decisions will show how this operates. The following are taken from the minutes of the team:

- *Pin, part No. 28741.* A lower purchase quote cuts profit advantage from plus $5.05 to plus $1.94. As this part will be obsolete in the near future remaining quantities will be purchased.
- *Cam gear, part No. 79614.* A 65 percent reduction in time for broaching changes profit advantage from minus $3.57 to plus $4.03. This part should be made in the plant.

Fig. 6. Drawing of four-bladed fan. Balance of part is critical for quiet function.



- *Shutter release pin, part No. 46243.* This part was assigned some time ago to the purchase list with a plus $4.32 profit advantage. The reason for this decision was that the committee believed the part could be cold headed cheaper than the company could make it. Price received from purchasing changes profit advantage to minus $2.70. It will remain on purchase list.

In addition to parts normally falling in the purchase-make area, the production planning representative maintains a list of parts which do not have routings or tooling in the plant. These, as well as parts not on any list, may be taken up by the committee for reconsideration of their status, if warranted by changed conditions. This gives the company much more flexibility to meet the fast-moving competitive situation that prevails today, which is often difficult under rigid purchasing policies laid down by top management.

For instance, a four-bladed fan, *Fig.* 6, was originally placed on the outside where it could be ordered as a standard item. Serious service difficulties were encountered, however, with the first shipment. Quiet operation is desired. Because of unknown design factors too high a noise level occurred. It was realized then that the functional requirements are such that the stamping should probably be made in the plant where design, tooling and production could be carefully coordinated.

The problem was submitted to tool engineering without delay. A progressive die was developed in time to meet production schedules. It has produced satisfactory parts on high production runs, *Fig.* 7, without any special difficulties. In fact, the tooling has proved so good that a saving of $0.11 each was secured, which could not be anticipated from preliminary data that was available.

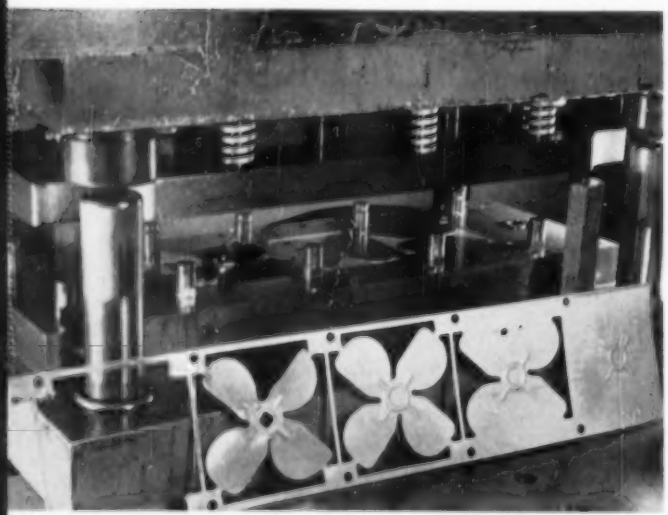


Fig. 7. Stamping setup for four-bladed fan in press, showing progressive operations on workpiece (foreground).

Another aspect of operations research being utilized advantageously in production planning and scheduling is the model in the form of a large wall chart, *Fig.* 2. This gives a visual check of status of high production items and affords a means of ironing out production difficulties before they become serious. With this and lists of parts, by classes of machines, to show the declining profit advantage, scheduling is simplified. Now it is possible to readily determine for any given production level which parts should be purchased and which should be scheduled in the plant. Facilities can be utilized most effectively and at the greatest profit to the company.

The application of these techniques to practical everyday problems of manufacturing have achieved thousands of dollars in savings. Furthermore, these methods have brought to bear the considered judgment of a well-rounded team, based on the best facts available. Contrary to general belief, the committee procedure has streamlined the decision making, results in more rational decisions and also permits them to be made in line with the company policy of participative management. Such committee or teamwork serves as a valuable training ground in the management development program.

While the data originally developed were conceived as only accurate enough for a scheduling guide, they have proved useful in many other ways. Continuing improvements by accounting with the cooperation of contributing departments have resulted in a valuable tool for product design, choice of tooling and for purchase of capital equipment. For instance, by application of the data form it is possible to determine the best kind of tooling for producing a given stamping, whether it should be a series of simple and compound dies or a progressive die.

A comparison can be made between alternate processing methods. Tooling decisions can be made with greater assurance of whether it is best to design and make it within the plant, or design inside and make outside, or send the entire job outside.

Other related production problems, such as in-process inventory and that of the best lot sizes, have also been analyzed by operations research techniques. A form of linear programming has been developed which can be applied with minimum mathematical calculations. This has resulted in substantial improvements in handling, as the most economic lot sizes are now processed.

The application of operations research methods has not eliminated the many problems and decisions of manufacturing management. Rather it has simplified them by revealing the most pertinent information and by organizing known facts so they can be dealt with constructively.

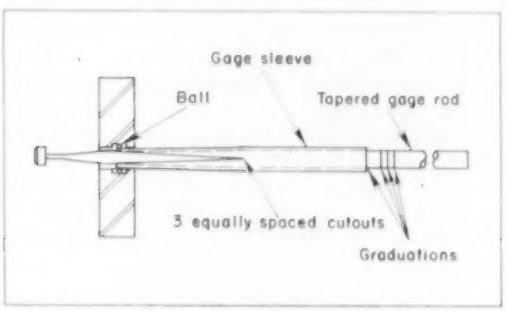
Gadgets

Ingenious Devices And Ideas To Help
The Tool Engineer In His Daily Work

Gage for Groove Diameters

When production volumes for a part are sufficiently high, it is desirable to use special gages to expedite inspection. Many special-purpose gages are available; often, however, it is possible to design and build a satisfactory gage in the toolroom.

The gage illustrated, which is used for checking groove diameters in a small workpiece, consists of a tapered rod which slides freely in a sleeve. There are three equally spaced cutout areas on the sleeve.



A small ball is brazed to each of the three points formed by the cutouts. In use, the gage is inserted in the hole in the workpiece with the three balls positioned in the groove to be gaged. The tapered rod is then pushed toward the workpiece, forcing the balls into the groove. To withdraw the gage, the sliding rod is pulled away from the workpiece, releasing the pressure on the balls. If necessary, the cutout end of the sleeve can be squeezed to facilitate insertion or withdrawal of the sleeve from the hole.

Initially, the gage is calibrated with the aid of ring gages. Settings are indicated by graduations marked on the end of the sliding rod. Thus the gage can be read directly by sighting the end of the sleeve on the graduations on the gage rod. Ease of operation, plus the direct-reading feature make this gage an effective inspection tool, and the same design principles can be adapted for gages used to inspect similar hard-to-get-at areas.

G. R. Page
Peterborough, Ont., Canada

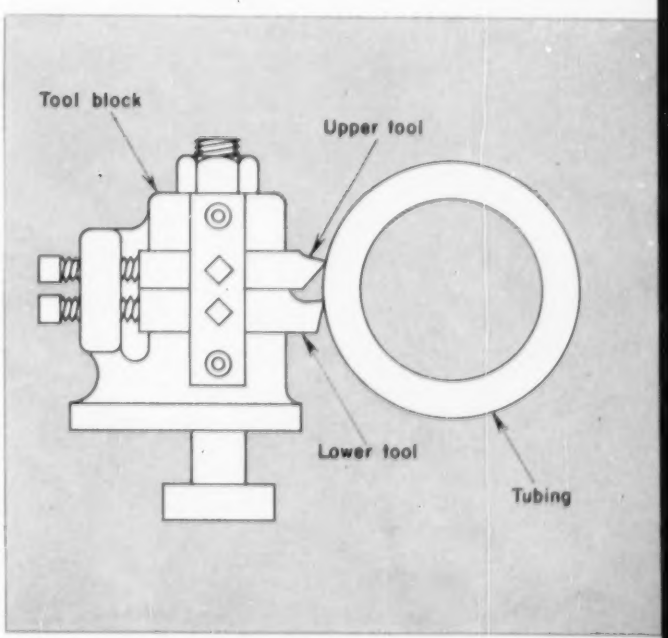
Cutoff Tool for Tubing*

Problems connected with cutoff operations on steel tubing were completely solved with development of the tooling illustrated, which is used in an engine lathe. Two tools are held in a rigid tool block. The upper tool is 20 percent narrower than the required width of cut and is used to hog out the groove. The lower tool, which is essentially a shaving tool, brings the cut to full width. A steady rest or follow rest supports the workpiece.

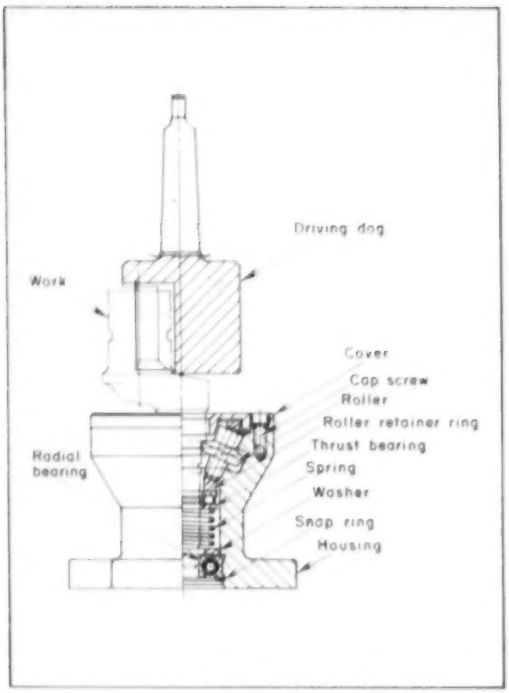
Both tools are ground to converge on a common center, as shown. The upper tool, which is placed slightly above center, leads the lower tool into the cut by 0.002 to 0.010 inch, depending on the tubing size. The lower tool is slightly below center.

This type of tooling operates well under power feed and chatter is minimized. It is used for tubing ranging from two to six inches in diameter and can be adapted to perform cutoff operations on all types of tubing, provided that the ID is not less than one-half the OD.

R. F. Stallman
Golden Gate Chapter



*Gadgets Contest Entry



Cold Rolling Tool*

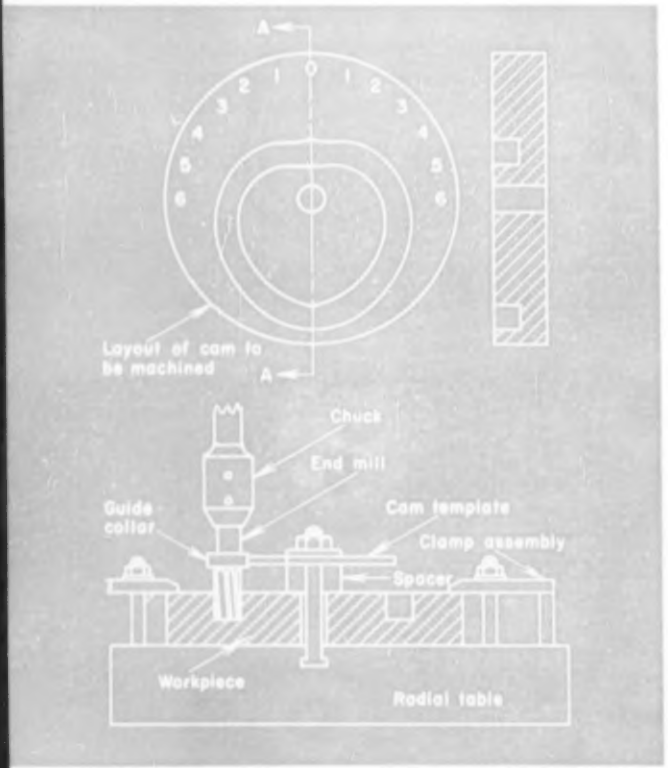
Cold rolling is an effective means of improving surface finish and fatigue strength of critical areas on crankshafts, fan shafts and similar parts. The tool illustrated is designed for cold rolling of a diameter and shoulder on a fan shaft. It can be used with either a drill press or lathe.

One end of the shaft is held by a driving dog. The other end of the shaft, which includes the area to be rolled, is fed into a rolling fixture. The fixture consists of a housing containing a hardened and ground roller set at an angle. Construction details of the fixture are evident from the accompanying drawing.

As the rotating shaft is fed into the fixture, a mirror-like finish is produced on the areas which contact the rollers. This operation takes only a few seconds. Use of the rolling operation has eliminated fatigue failures of the fan shafts in service. Similar tooling can be used for improving the surface finish and fatigue strength of many similar cylindrical parts.

William E. Sjostedt
Member-at-Large
Soldertalje, Sweden

*Gadgets Contest Entry



Milling Internal Cams*

Accurate milling of internal cams is considered a difficult operation by many toolmakers. The setup illustrated simplifies cam milling operations and enables them to be performed with a high degree of accuracy on a conventional vertical mill. In this setup, an end mill is fitted with a guide collar which follows the contour of a cam template during machining. The collar is hardened and ground and is a running fit on the end mill shank.

The first step in preparation for milling the internal cam is, of course, laying out the cam template. This should be done accurately, since the accuracy of the internal cam can be no greater than that of the template. In laying out the template, the diameter of the guide collar is taken into account so that the groove will be correctly located.

With the template made, the cam blank is next positioned dead true with the radial table of the vertical mill and clamped as shown. The template is then fastened to the radial table in proper relation to the cam blank, using a spacer to hold the template at the same level as the guide collar on the end mill.

Roughing operations are performed first. The

diameter of the end mill used for roughing should be at least $\frac{1}{16}$ inch less than the width of the cam groove, allowing $\frac{1}{32}$ inch on each side for the finish cut. Finishing is accomplished with an end mill whose diameter is 0.002 to 0.003 inch smaller than the final width of the groove. This small amount of stock is left to compensate for any wobble or runout of the end mill.

After finish milling is completed, the groove is tested with a plug gage and a draw file is used to remove high spots. When these are removed, a gage of the proper diameter should pass freely through the entire groove without friction. Following draw file operations, the groove is polished.

There is one important rule to remember during milling the groove: the guide collar must not turn with the end mill. When the guide collar turns with the mill, it is not in contact with the template. If this happens, the cutter should be moved over until the collar stops revolving. By exercising care in laying out the template and setting up the job, the machinist should have no difficulty in milling accurate internal cams.

John F. Rachwal
Buffalo-Niagara Chapter

***Gadgets Contest Entry**

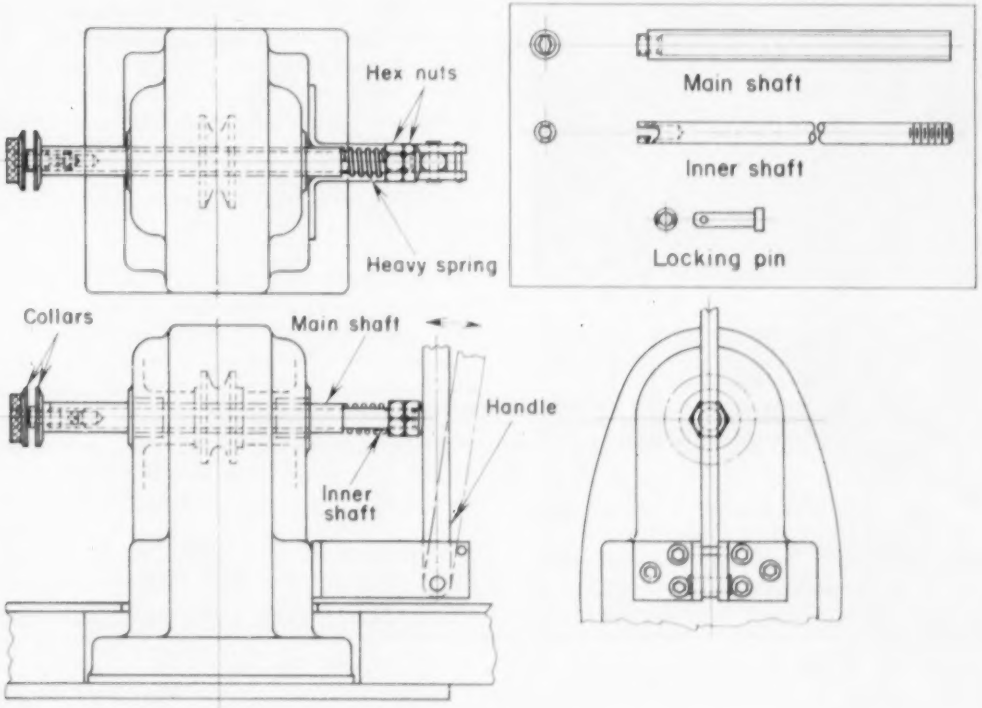
Quick-Change Brush Head*

This quick-change brush head was designed to meet the need of a wire-brushing operation where frequent brush changes were necessary. Details of the head are evident from the accompanying drawings.

The main shaft is hollow and the brush is held on a pin locked into a spring-loaded shaft inside the main shaft. For quick changing, the lever arm at the right end of the head is used to depress the spring. The pin holding the brush is unlocked by being turned 90 degrees. The brush can then be withdrawn from the shaft. To install a new brush, the procedure is reversed.

In production, the quick change head has functioned effectively, minimizing the down time associated with brush changes. It is well-suited to other light buffing and brushing operations where reduced brush change time is desired.

Karl W. Nittel
***Gadgets Contest Entry** *Southeastern Mass. Chapter*



Gadgets

Work-Holding Fixture

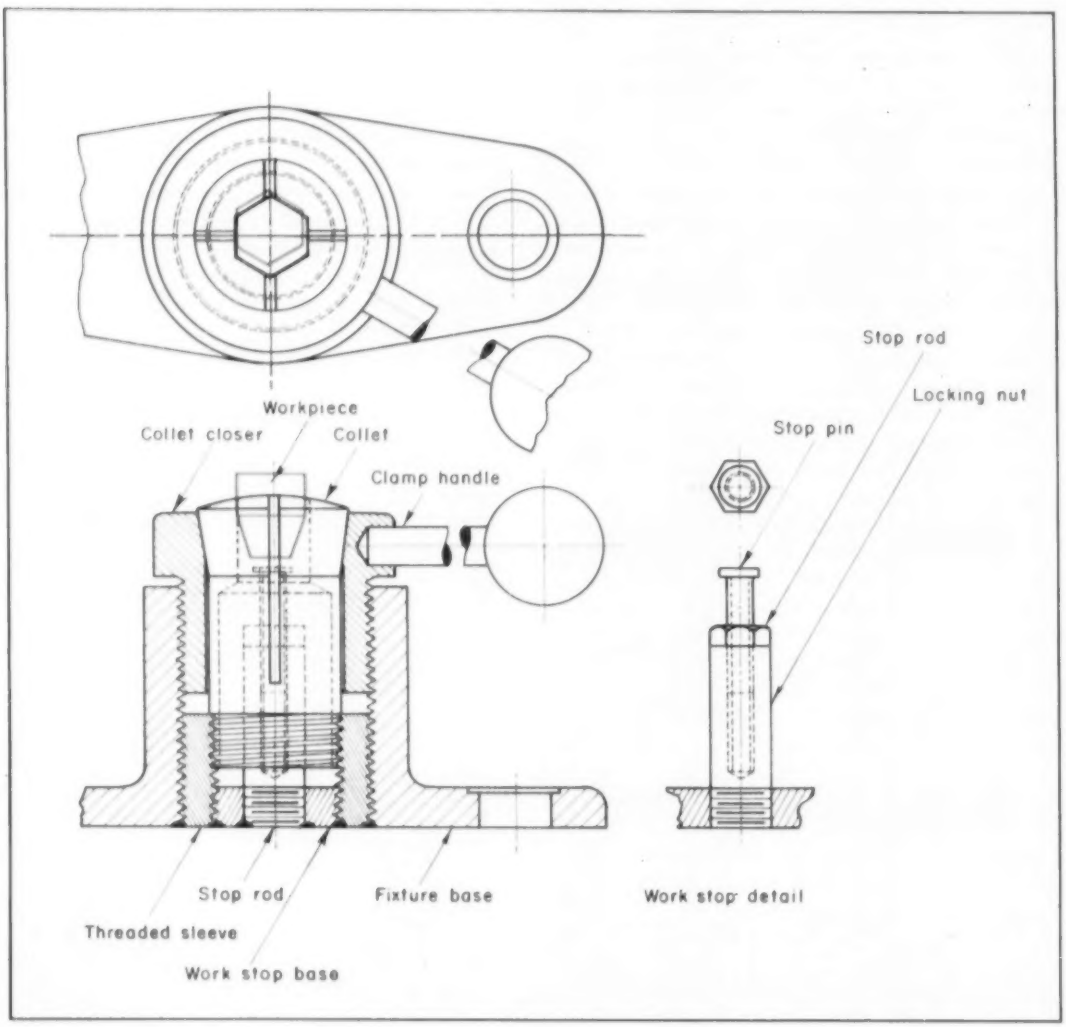
Often a fixture is needed to provide quick and positive clamping of symmetrical workpieces for drill press and milling machine operations. Simplicity and versatility are highly desirable. Standard collets are used in the "universal" work-holding fixture illustrated.

The collet screws into a threaded sleeve, which in turn is screwed into threads provided in the base. The bore of the fixture base is threaded with left-hand threads to provide right-hand clamping of workpieces in the collet. A workstop base, threaded into the sleeve, holds a work-stop assembly, which is made up of the base, a stop rod, stop pin and standard locknut. The stop pin is threaded to screw into the internally threaded stop rod for final adjustment, and is held in place by the locknut. The threaded sleeve and work-stop base could be made in one piece if desired.

A collet closer compresses the collet onto the workpiece, locking it into position for machining operations. The collet closer is threaded to fit inside the fixture base and is beveled to fit the taper on the underside of the collet. A handle is attached to the collet closer.

All components of the fixture except the fixture base and the collet closer are made of cold rolled steel. Hardened tool steel is used for the latter parts to minimize wear.

Frank L. Rush
Columbus, Ohio



impact and high-velocity FORMING

. . . the trend toward explosive techniques

By R. W. Peters*
Chief Tool Engineer
Convair
Div. of General Dynamics Corp.
San Diego, Calif.

Without definite action to improve and develop equipment for the aircraft industry, lack of adequate production methods required by new materials may have serious consequences. The author describes early advances toward new forming techniques and equipment, and gives initial proof.

Fig. 1. Formed sheet-metal part on the form block after being struck by the trapped-rubber head of a drop hammer.

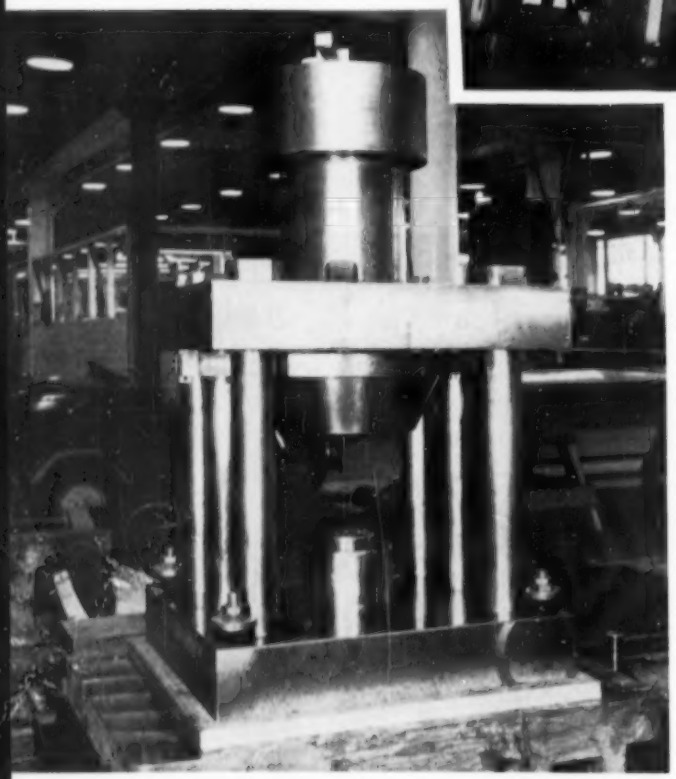
NEVER BEFORE in the history of aircraft production have material and manufacturing equipment problems been as critical as they are today. The airplane of tomorrow is already in the predesign stage. Materials of which these planes will be fabricated are now in advanced development and testing stages. Manufacturing techniques with which to work these materials have not been clearly defined. Design engineers are hampered by process limitations.

Future combat aircraft will be constructed of strong, heat-resistant metals. A minimum tensile strength of 200,000 psi will be required and high strength must be maintained at elevated temperatures. At the present stage of development, it appears that martensitic stainless steel may offer the best answer to many of the material problems. Such steels have been developed with primary emphasis on physical properties; little attention has been paid to problems of formability and processing.

*Senior member ASTE San Diego chapter.

Fig. 2. (right) Heavy, trapped-rubber forming head of a drop hammer is poised over the anvil, which is mounted on the hammer bed.

Fig. 3. (below) Experimental, explosive forming press uses a pelletless 12-gage shotgun shell as the propellent.



Tool engineers at Convair were quick to recognize the potential lack of fabrication capabilities. Since Convair does not build machine tools, their efforts have been restricted to improving techniques and altering existing equipment to meet current needs.

Impact Forming

A little over two years ago, Convair started working with impact or "trapped rubber" forming on a drop hammer. Sheet metal blanks are placed on a male form block, *Fig.* 1, which rests on a bed-supported anvil. A rubber head, surrounded by steel to retain it and add weight, *Fig.* 2, is dropped from a height of 30 inches. The 8970-lb weight of the head strikes the sheet with considerable impact and forms it over the block.

The one big difference between this and conventional rubber forming (Guerin process) is that the rubber strikes the part instead of exerting a slow squeeze. This process proved to be highly successful from the start. Hand forming, normally required after most conventional rubber forming, is almost unnecessary. In fact, many of the parts are formed so completely, without springback, that they must be forced from the form block.

It was obvious that pressures were higher with this impact process than those achieved by a conventional 4500-ton rubber forming press but measurement of the instantaneous pressure was difficult. It was determined, however, that a pressure in excess of 10,000 psi is obtained as compared to the 3,000-psi pressures slowly developed by the 4500-ton press. This helps to explain the more thoroughly formed parts produced by the same tooling.

Impact forming is economically competitive with many other types of forming. Several small parts can be completely formed with a single blow of the trapped rubber head. Since the action of a drop hammer is fairly fast, an average of two cycles per minute can be maintained with one operator and two assistants.

Aluminum or magnesium tooling plate is satisfactory for tooling most short-run production jobs, under average conditions. If production quantities

are expected to be high or if parts of the tool have small cross sections, the form block should be made of mild steel plate. It is important to keep form blocks smooth and free of nicks, scratches, etc. The impact pressure is so great that any irregularities in the form block surface will be transferred to the formed part.

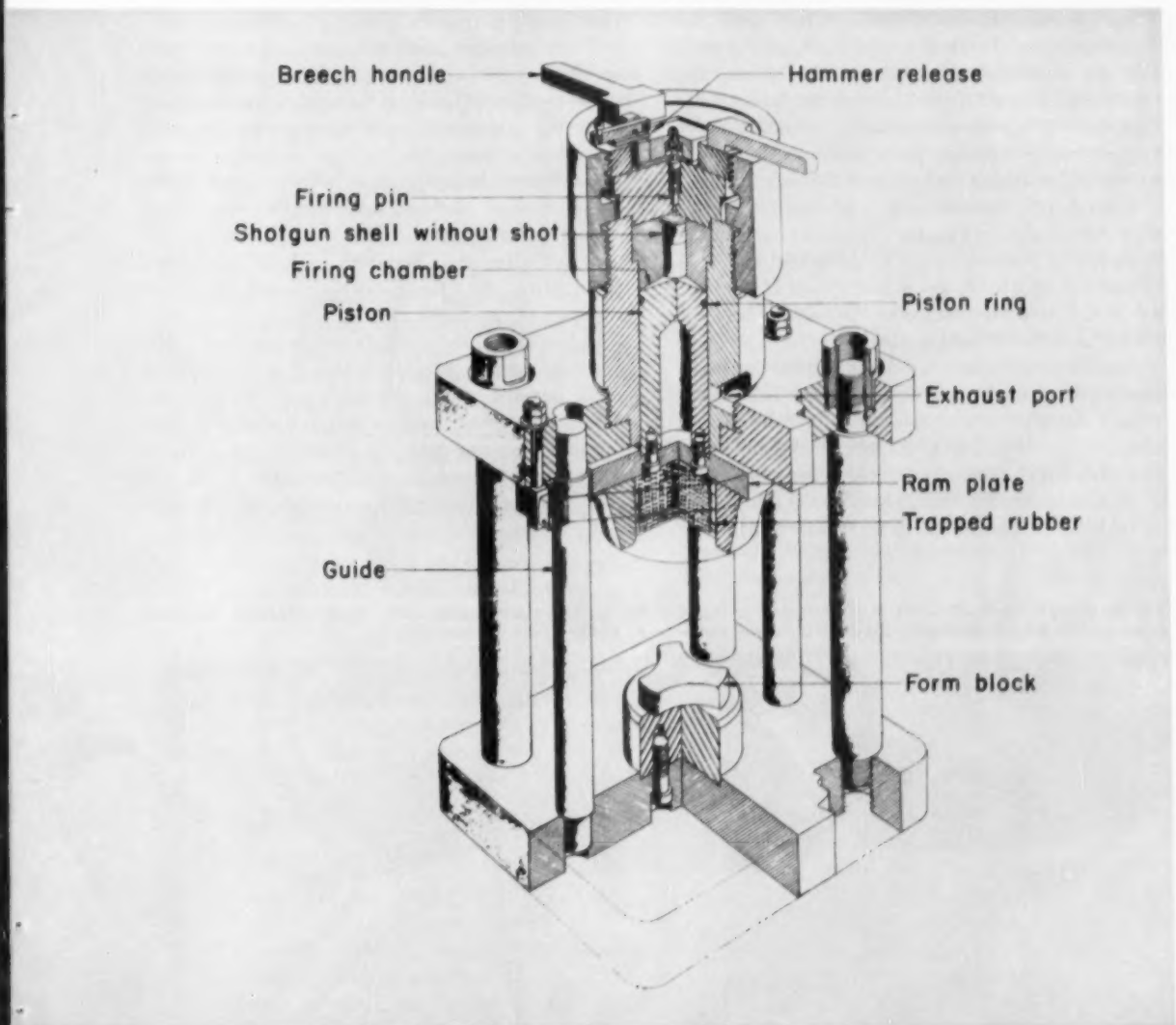
High-Velocity Forming

The fact that more completely formed parts were obtained with a high impact, and the consequent increase in pressure, indicated a possible trend. Would additional impact be beneficial? If so, how much and how could it be obtained? A study of the drop hammer revealed that it was already being stressed to its limit and further loading would be unsafe. This ruled out the possibility of propelling the rubber head by application of air, steam or explosive pressures. After much consideration, it was decided to approach the problem on a laboratory scale. With small-scale operations, the value of additional impact pressures could be determined at a fraction of the cost of altering or building full-scale equipment.

A device was designed, *Fig.* 3, having a trapped-rubber head, anvil, piston and cylinder. It uses a 12-gage shotgun shell, without shot, as the driving force. As can be seen in the cutaway drawing, *Fig.* 4, the design is patterned after the principles of impact forming in a drop hammer. This press was designed and constructed to prove the value of higher impacts and was not intended to be a piece of production equipment.

Some mechanical difficulties were experienced at

Fig. 4. Section view of the experimental explosive press shows the firing mechanism and the manner of guiding the trapped rubber head.



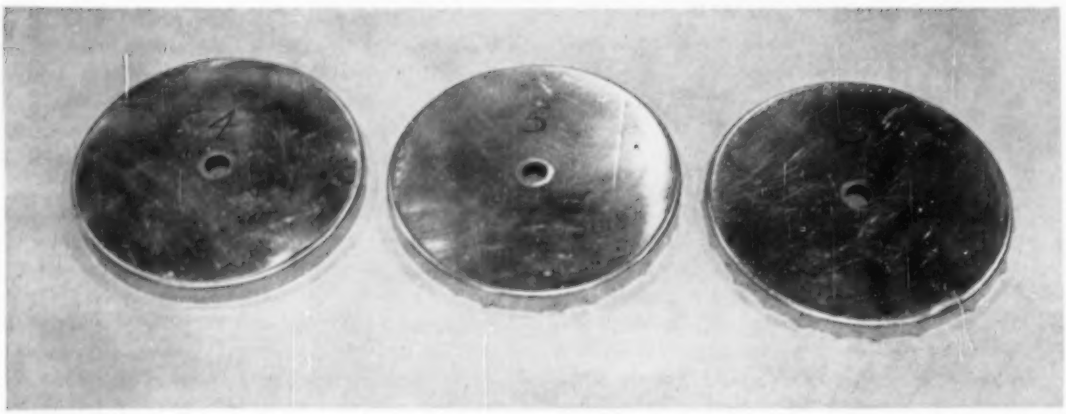


Fig. 5. Sample parts of 2024-0 aluminum, 0.020 inch thick. Left to right: parts made in the explosive forming press with a 99-grain charge, the drop hammer and a large rubber forming press.

first but these were soon corrected. A number of parts were formed of aluminum and stainless steel. These were compared with similar parts, *Figs.* 5 and 6, formed over the same tool on the impact press and the conventional rubber forming press. The small experimental press formed the parts more completely than either of the other methods. Powder charges in the explosive press were varied from 33 to 150 grains during the course of the experiments.

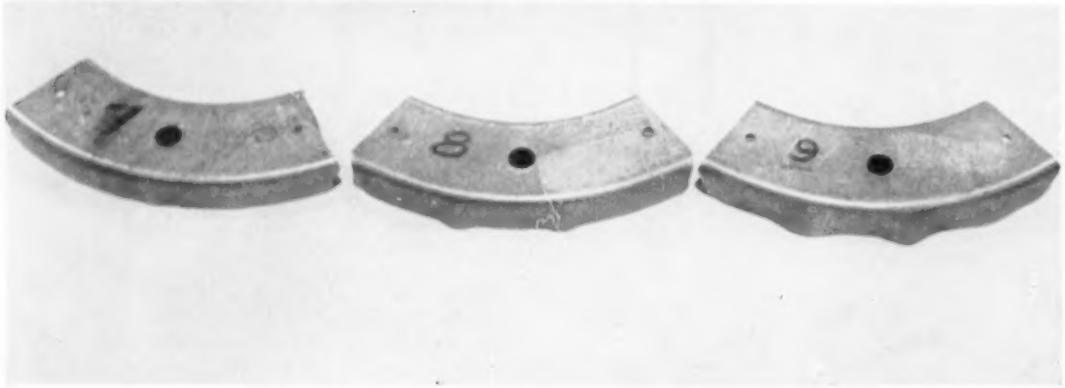
Several attempts were made to physically measure the pressure obtained on the explosive press. Action is so fast and pressures are so great that available measuring equipment was not adequate. It has been calculated that instantaneous pressures between 30,000 and 50,000 psi are obtained.

Results of forming tests conducted on the small experimental model are encouraging. Difficult-to-form parts are more completely formed by the explosive force of a 12-gage shotgun shell than is possible with a 4500-ton conventional press. From these experiments, it can be concluded that the advantages of high-velocity forming will be smaller production equipment, higher production rates and increased ability to form large parts of high-strength materials.

There are other possible approaches to high-velocity forming. Several offer definite possibilities in the field of metal forming. Some work has been done using the explosive force directly against the metal sheet over a female die. Another method is the use of explosives in conjunction with confined fluids. Some of these methods may be effective only on certain part configurations. If the maximum benefit is to be derived from high-velocity forming of sheet-metal parts, all of these approaches will have to be studied and developed.

Before any of the methods can be exploited fully, much information must be obtained on the effects of rapid forming on all commonly used aircraft materials. The work done so far indicates that high forming rates are definitely beneficial for many of the commonly used aircraft materials. Work will also have to be projected to include high-strength materials as they are developed.

Fig. 6. Sample parts of 0.051-inch annealed stainless steel. Left to right: parts made in the explosive forming press with a 99-grain charge, the drop hammer and a large rubber forming press.



planned approach cuts manufacturing costs

By Peter J. Baima
Design Engineer
Solar Aircraft Co.
San Diego, Calif.

Manufacturing cost reduction programs should be cooperative ventures, involving tool engineers, product design engineers and top management. The author, who has long experience in turbine manufacture, outlines important points to be considered when setting up a cost reduction program.

HIGHER WAGE RATES and increasingly sharp competition in American industry have made cost reduction and continuing product improvement a necessity. Ideally, a product should be designed for lowest-cost manufacture and much can be accomplished if tool engineers review product designs for manufacturing feasibility before final part prints are made. Similarly, every effort should be made to select the most efficient manufacturing methods at the time the job is first processed. Experience has shown, however, that continuing analysis of products and processes from a manufacturing standpoint during production runs often leads to significant improvements.

Starting the Program: Best results are obtained when cost reduction programs are conducted on an organized basis. The first step is, of course, to determine what parts or assemblies are the most costly to manufacture. Efforts at cost reduction will logically start with these items.

Some reasons for excessive costs are readily apparent, even in an initial survey. These include:

- Extremely close tolerances
- High surface finish requirements
- Complicated design, leading to difficulties in forming, machining or assembly
- Expensive materials or heat treatment
- Use of specially designed components which could be replaced by less expensive standard components.

A more detailed survey will disclose many other reasons for excessive costs and may suggest the need for considering alternate manufacturing processes, revised sequences of operations or better material flows. At this time, however, the objective is merely to develop a list of parts and assemblies from which the most likely targets for cost reduction can be selected.

Management Support: Once the list has been made, it is important to obtain full management support for further analysis and evaluation. This makes it possible to obtain the cooperation of all of the departments that may be involved. It is also essential to obtain records giving information as to past changes in design or manufacturing methods. Adequate equipment and personnel for design, fabrication, research and testing must also be provided. Properly conducted cost reduction programs take time, money, and engineering talent, and efforts to economize on such programs may prove, in the end, to be false economies.

Alternative Processes: Determining which parts on the list are the most promising from the standpoint of lowering costs requires a meeting of the minds between project engineers, manufacturing department representatives and others. Direct and indirect labor costs, material costs, rejection rates, projected production volumes and functional requirements are considered in selecting parts for further evaluation.

After agreement is obtained, the next step is to make a thorough analysis of the parts and assemblies in question, evaluating fabricating processes, tolerances, assembly methods, surface finishes, heat treatment, coatings and methods of joining.

The following check list has been found useful in

evaluating possible areas of cost reduction for a given part or assembly. Many of the questions raised may require considerable study and testing before it can be determined whether or not they are good solutions to the problem at hand.

- Can the part be made of a cheaper material?
- Is it possible to simplify the part design?
- Can the part be easily set up for machining?
- Is it cheaper to cast the part than to machine from solid stock?
- Will special machines or automation reduce production costs?
- What is the effect of replacing welding operations with brazing?
- Can subsequent assembly operations be simplified?

Each of these points will be discussed in some detail.

Materials: Making a part from a carburized steel, rather than alloy steel, should be fully evaluated. Not only will material costs be lower, but machining time may also be reduced. In this instance, as most others, however, several other factors may affect the cost picture. Carburizing is an additional operation which may not be justified unless product volumes are high. In addition, extensive testing will be required to determine if the carburized part performed adequately from a functional standpoint.

Product Simplification: Many product design engineers are, understandably, not familiar with specialized manufacturing problems. Tool engineers and manufacturing supervision may not, on the other hand, fully appreciate functional requirements. Product simplification to facilitate manufacturing is, necessarily, a cooperative endeavor.

One possible approach to product simplification is to consider the possibility of redesigning an assembly as a single part. This will eliminate assembly costs and, in many cases, reduce over-all manufacturing costs. Additional savings result from reduced inventory and handling expenses. It should be noted, however, that some complex parts can be more economically produced as assemblies.

Often, welding operations can be eliminated by judicious use of standard structural shapes or bends. A close look at the function of a part may show that stringent surface finish requirements are unnecessary. Costs of fine finishes increase geometrically with the smoothness of the finish. Many other ways in which a given product can be simplified for more efficient manufacture suggest themselves when all pertinent functional and processing requirements are taken into consideration. Addition of bosses on a machined part, for instance, may greatly facilitate setup without interfering with the function of the part.

It has been estimated that the total annual cost of making chips in the United States is in the neighborhood of $12 billion, illustrating that important cost savings can be realized when it is possible to reduce or eliminate machining operations. This can often be accomplished by replacing a machined part with a precision casting. Shell-molded castings are dimensionally accurate and have good finishes. The process is adaptable to mass production. Small nonferrous parts can be made by the plaster mold process, with extremely good surface finishes. Other

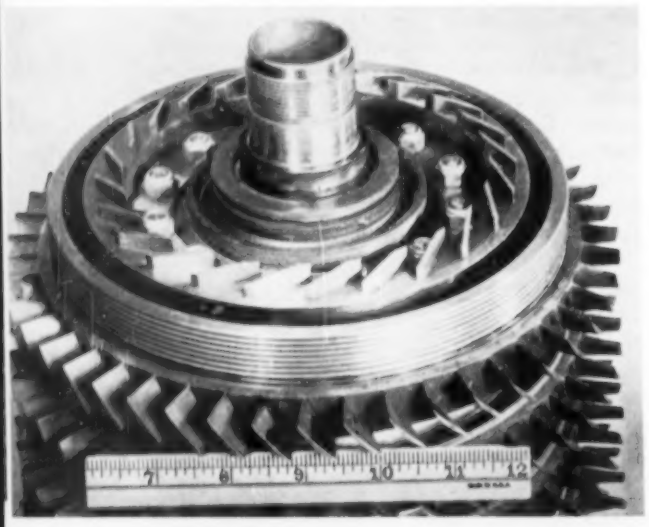


Fig. 1. (above) Cooling air impeller in the Solar compressor rotor was machined from plate stock and bolted to the hub. This machined part was replaced with a precision casting, which lowered the cost of the impeller and enabled the labyrinth seal grooves to be cast integral with the impeller.

Fig. 2. (right) Solar "Jupiter" turbine rotor rotates at 20,000 rpm. Tolerance on the critical dimensions of the "fir trees" which hold blades to the wheel was 0.0002 inch. Testing showed that this tolerance could be increased to 0.0006 inch, with resultant savings in reject cost.

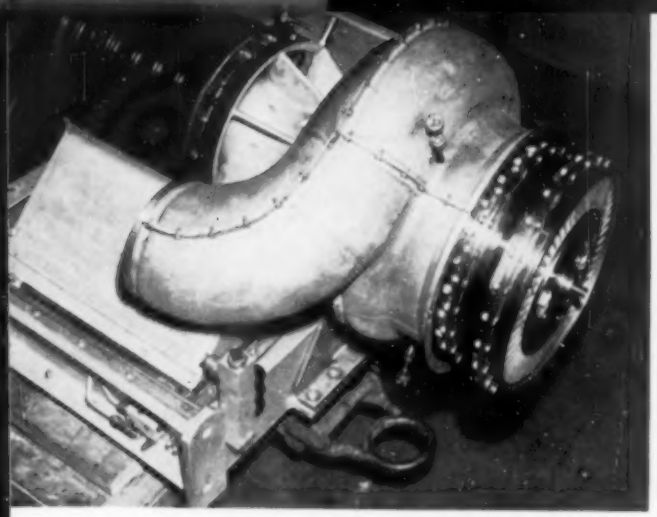


Fig. 3. Two bolted casings of the Solar "Jupiter" turbine (at right of photograph) were combined into one casting, with substantial savings in machining, assembly and fastener costs.

precision casting methods, such as the lost wax process and the Shaw process, permit castings with large undercuts and intricate cores to be made. These castings, *Fig.* 1, are relatively expensive but the added cost can often be justified if machining operations are eliminated.

Another possible way to avoid extensive machining is to redesign machined parts for production on a punch press. If quantities are large, the increased tool cost is quickly offset by the speed and ease of stamping.

Tolerances: Close dimensional tolerances raise manufacturing costs and are an increasingly significant factor when applied to machined parts made of hard or tough materials: stainless steels and the "super-alloys," for example. It is usually more economical to hold a part to close tolerances than to have an extra fitting operation at assembly, yet there are many exceptions. In one case, the dovetail on a compressor blade was originally dimensioned to a total tolerance of 0.0002 inch. The cost in rejected parts due to failure to maintain the required tolerance was prohibitive. A boss was added and the tolerances increased to a total of 0.0004 inch. The boss was ground to fit at assembly. Savings realized by the substantial decrease in the number of rejected blades more than offset the added cost of grinding at assembly. Similarly, it was found that tolerances on "fir tree" which holds blades on a turbine wheel, *Fig.* 2, could be safely increased from 0.0002 to 0.0006 inch.

Assembly: In assembly operations, brazing is often more economical than arc welding, since the brazing process lends itself to mass production methods. The strength of properly designed brazed joints frequently exceeds the strength of the base metals joined. This makes it possible to redesign complex parts as brazed assemblies, made up of simple individual parts. The economics of such a redesign can best be determined by a study of relative tooling and labor costs.

If much time must be consumed in fitting, adjusting or reworking parts at assembly, costs can skyrocket to a point where a product is not competitively priced. Some of the points to check are the build-up of tolerances at assembly; the design of the assembly itself, particularly with reference to ease of assembly; and the feasibility of making subassemblies as units, *Fig.* 3, thus saving time and avoiding subsequent fitting and fastening operations at final assembly.

New Processes: New and improved manufacturing processes offer many roads to substantial cost reductions. Ferrous and nonferrous extruded parts, for instance, are being extensively used in preference to parts machined from solid stock. The range of applications for die castings is being substantially extended with the development of alloys with high physical properties. One such alloy has a tensile strength of 90,000 psi. Intricate shapes can be economically formed by the electroforming process. Machines are available for the cold-forming of splines and serrations, eliminating hobbing operations and cutting material costs. The "Ballizing" process for finishing through holes is cheaper and faster than reaming.

With the constant development of new processes and machines, it is difficult to keep abreast of all the potential means by which manufacturing costs can be reduced. At the same time, knowledge of new processes is essential. Both tool engineers and product designers should keep in touch with current developments by participating in the activities of technical societies and reading engineering journals in their fields.

When considering the adoption of a new process, all relevant factors must be evaluated in the light of available production facilities and experience. Changes which require the learning of new techniques and methods must effect sufficient savings to offset the cost of the "learning curve" plus the capital investment required for new machinery and equipment.

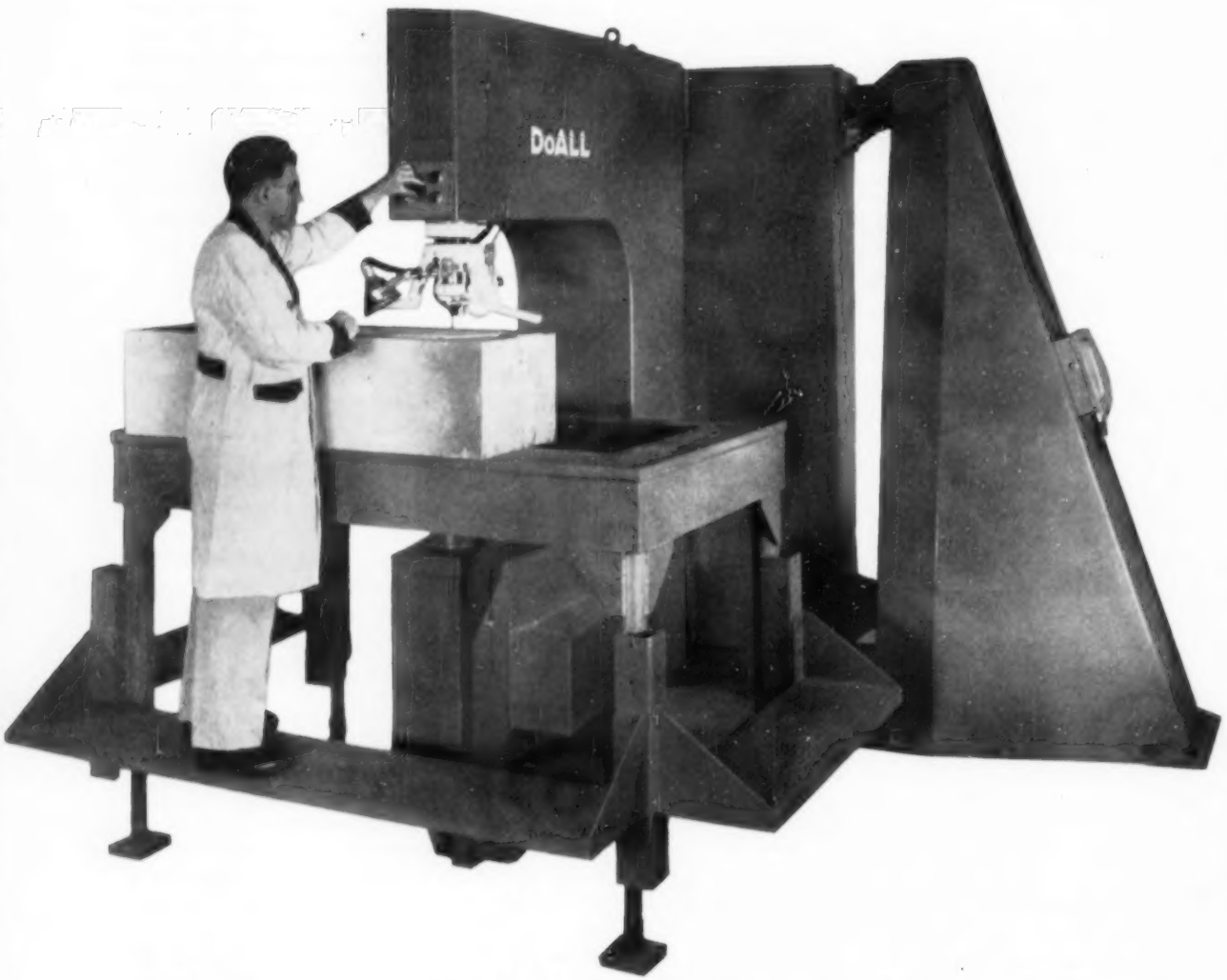
If a company has no production experience with a proposed new method of fabrication, it may be more economical to have parts made by a firm specializing in that type of work. This may be especially desirable in order to establish the practicability of the new method without heavy investment in training or machines.

The size and scope of cost reduction programs will vary from company to company. With thorough planning, adequate personnel and testing facilities, and full management support, such programs will lead to more efficient manufacturing operations.

designed for

PRODUCTION

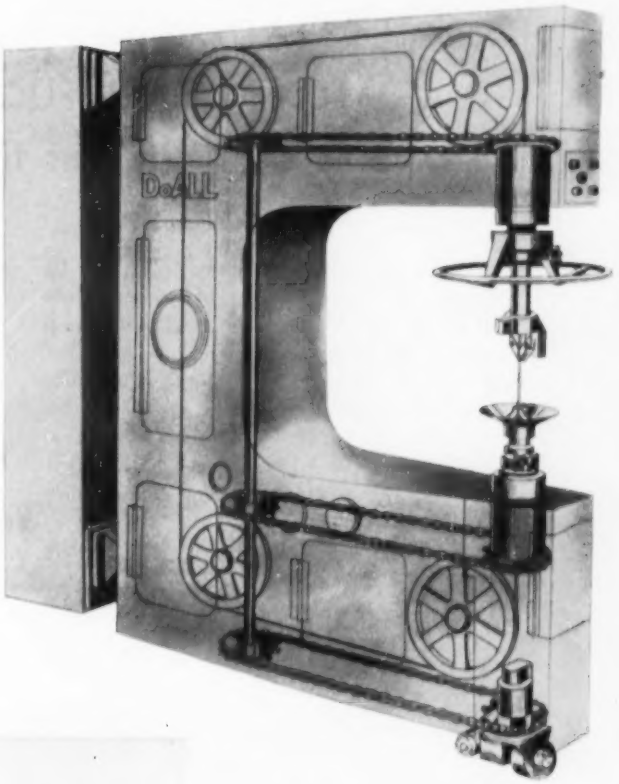
Articulated Contour-Sawing Machine Cuts Stationary Workpieces



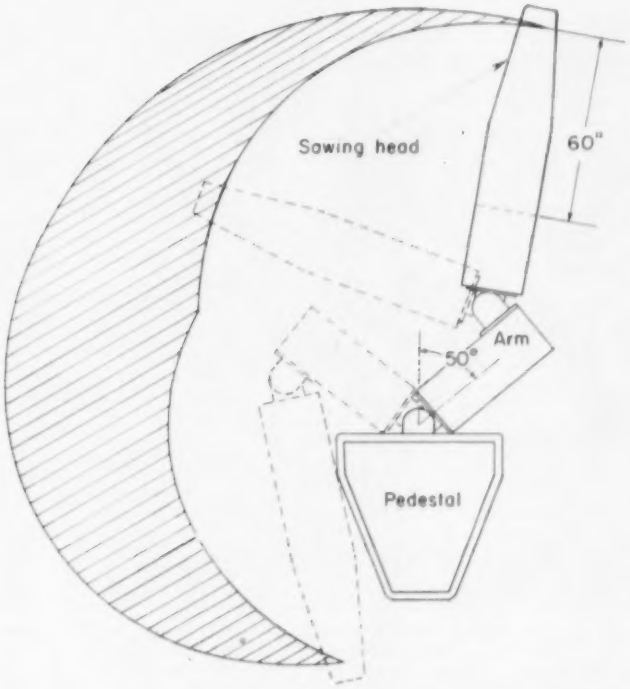
LARGE DIE BLOCK is sawed on articulated machine. Cutting and guiding mechanisms are carried by a yoke that contains a complete band-sawing machine. The yoke is made of aluminum to reduce inertia. Between the yoke and the stationary pedestal, which is fastened to the floor, is an intermediate arm. These three members are connected by hinges using anti-friction bearings.

When a workpiece is heavy, ungainly or unbalanced, it is easier to move the tool than to move the work. With an articulated band-sawing machine, it is possible to saw contours in blocks or stacks of metal that would be too awkward to handle if the saw blade location were fixed. This machine, developed by The DoAll Co., can be used in the airframe industry and will have wide application in the fabrication of dies.

In fact, this articulated band machine was developed because of the large dies required to tool presses built under the U.S. Air Force Heavy Press Program. Heavy work of this type need not be clamped and the operator's only tasks are to guide the saw and occasionally reposition the workpiece so the table or support bars do not interfere with the cut.



UPPER AND LOWER saw-blade guides are mounted on telescoping tubular posts to permit thickness adjustment. These posts and the power-feed wheel are interconnected through a countershaft and chains. The saw band can be twisted 180 deg in either direction by the hand-wheel and the feed wheel turns to aim in the same direction. Power feed is obtained by a torque motor that drives the feed wheel. This wheel can be raised if free swinging of the yoke is desired.



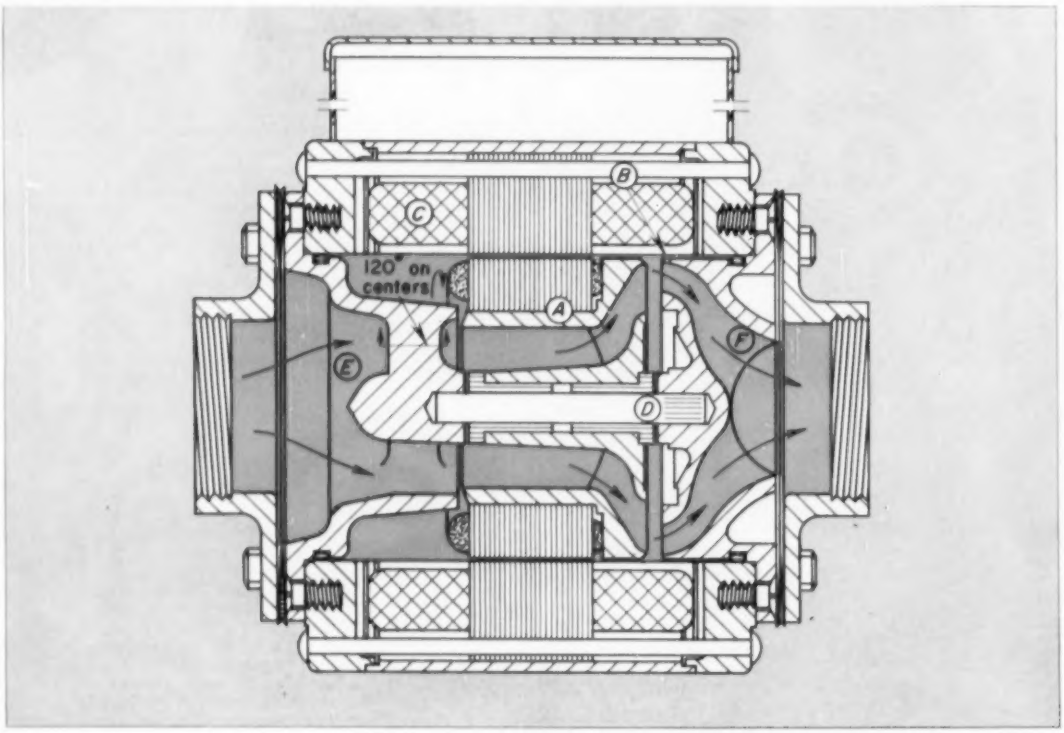
DESIGN of this articulated sawing machine is such that the band can cut anywhere in an area of 70 square feet (shaded area in the drawing). The longest straight cut possible without moving the workpiece is 14½ feet.

CANNED CENTRIFUGAL PUMP
transfers hazardous fluids

Radioactive and other dangerous liquids can be pumped in leakproof Magnaflow pumps. Fluid cannot leak out; air cannot leak in. The pumping chamber can be totally enclosed and, with special electrical leads, the pump can be operated submerged. Another design feature of this pump, developed and produced by The Corley Co., Inc., is that it is line supported. Also, it can be mounted in any attitude.

The pumping chamber is totally enclosed without stuffing boxes or lubricating ports. Pump housings can be built up to resist any pressures but bulk of the normal pump is only about one-quarter that of an equivalent, fractional-horsepower centrifugal pump. There are only two friction points in this pump. Normally, low-fricton carbon bearings are used at these two points between the impeller and the shaft. Where the pumped fluid would absorb carbon from the bearings, other materials can be used. Since the pumped fluid flushes the bearing surfaces, no external lubrication source is required.

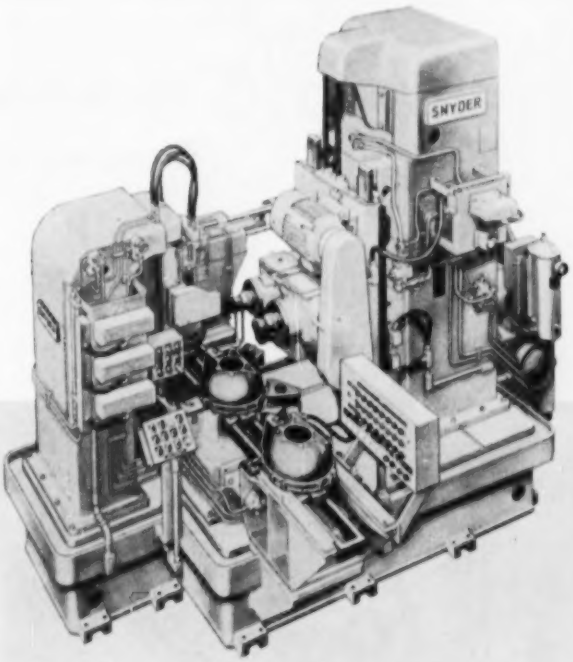
For higher heads, Magnaflow pumps can be connected in series. For larger capacities, these pumps can be used in parallel from inlet and outlet manifolds. When not energized, the pumps permit unrestricted flow.



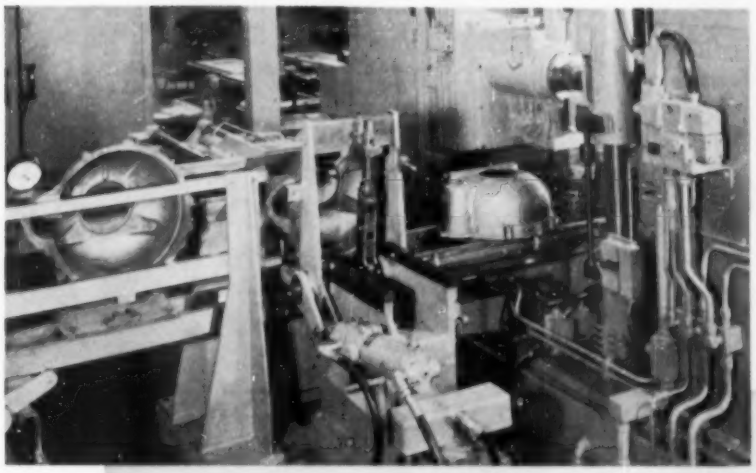
ONLY MOVING PART in this canned, centrifugal pump is the rotor-impeller, *A*. It operates within a stainless-steel sleeve, *B*. This sleeve physically isolates the stator, *C*, from the pumped fluid and magnetically acts like the air gap in an ordinary electric motor. Pumping action is provided by combining an impeller with the rotor. The rotor-impeller rotates on a fixed stainless-steel shaft, *D*, suspended between and seated in the intake manifold, *E*, and the diffuser, *F*.

Transfer Parts Slid on Rails To Avoid Pallets

Although the conventional method of handling small parts in transfer machines includes clamping each part in an individual fixture or pallet, this method has resulted in problems. Pallets are not used in this automotive transmission converter housing machine, developed by Snyder Tool & Engineering Co., and many problems are thus by-passed. Less floor space is required by the machine because no provision for pallet return is necessary. Also, pallet maintenance and chip clean-off steps are avoided. One of the most important results of sliding the workpiece through the machine without any restraint is that there is no question about possible workpiece distortion resulting from improper clamping.

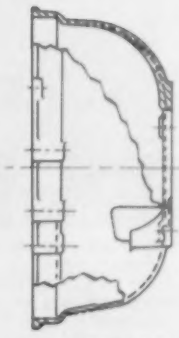


TARGET-MILLING is the first machining operation in a 24-station, 55-foot-long, segmented in-line transfer machine for finishing converter housings.

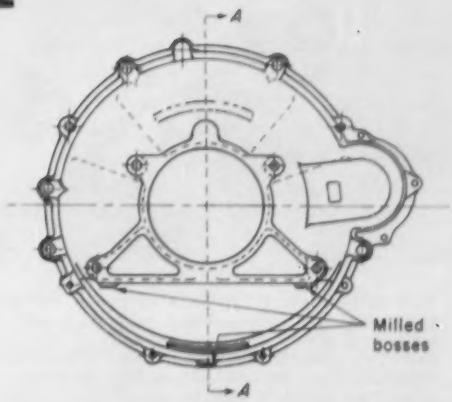


CONVERTER HOUSING is loaded face-down on rails at the first station and then transferred to the boss-milling station. In station four, the housing is pushed to one side of the line, tipped up and positioned so the bosses contact slide rails. It remains in this position for the rest of its trip through the machine.

THREE BOSSES are milled on the side of the cast-iron part, while it is located from critical clearance surfaces on the inside of the housing. The part is then tipped so that these bosses slide on rails for transfer between operations.

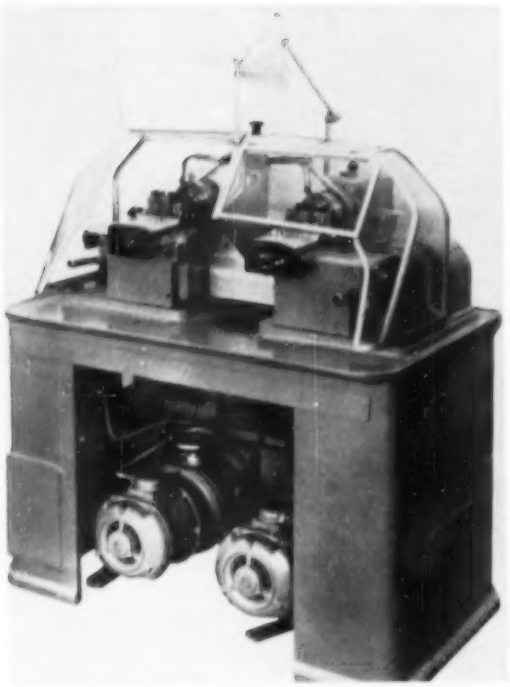


Section A–A



DESIGNED FOR PRODUCTION

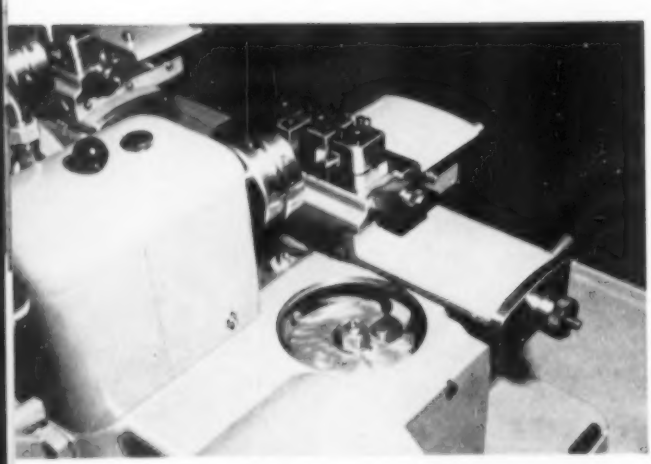
TWIN-HEAD LATHE
Reduces Production Time



Economical for use on short or medium production runs, this lathe features high precision for small parts. Production time varies according to the speed of the cams that control the inward and lateral movements of the tool. Cam speed can be changed simply by shifting a V-belt on four-step pulleys.

Each head also includes four movable stops so multiple diameters of different lengths can be turned independently of the cam controls. This lathe, developed by Kummer Frères (Switzerland) and handled by The Carl Hirschmann Co., has a lower-slide travel of $1\frac{37}{64}$ inches and an upper-slide travel of $\frac{25}{32}$ inch. Up to three square-shank tools can be mounted in holders on the upper slide.

TWIN-HEAD semiautomatic lathe has duplicate systems for power and control so heads can be operated independently. Models for turning ferrous metals have stepless speeds, variable from 410 to 3500 rpm. Nonferrous turning is done on machines with fixed speeds of either 2800 or 3500 rpm.

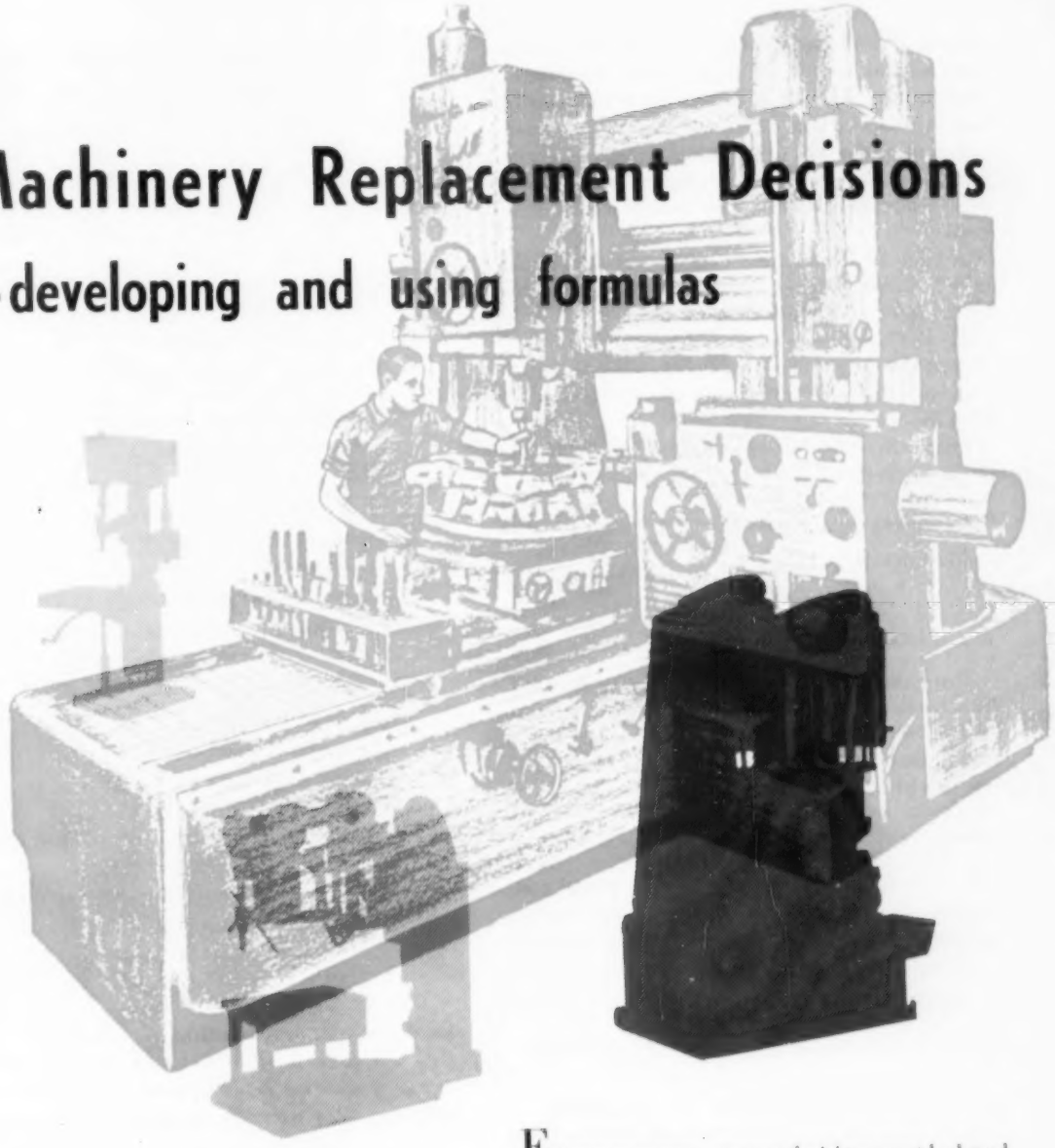


TWO CAMS control two sets of slides, set at right angles to each other, which move the tools in the horizontal plane. Forward motions of the tools are positively controlled by the cams; retraction is accomplished by springs. Depending on design of the cams, curved parts can be machined without form tools.

OPERATOR loads a blank in one pedal-operated chuck, and engages the slide motion and spindle drive by depressing a starting handle. The head then automatically turns the part. While the first head turns a part, the second head is unloaded and loaded. Coordinate cam action insures accurate control of the cutting tool.

Machinery Replacement Decisions

—developing and using formulas



By Martin H. Greenberger

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In making a distinct contribution to the literature on machinery replacement, the author corroborates previous work through an independent approach and a fresh viewpoint. The novelty of this approach may stimulate further study of this interesting subject.

EQUIPMENT REPLACEMENT decisions must be based on concentrated economic thinking and accurate estimates if a company is to remain competitive. Guesses, rules-of-thumb and hunches no longer suffice. Of the recent methods for correlating information prior to making a decision, one of the more notable is that developed by George Terborgh for MAPI.

In simple terms, this method relates time, efficiency and value in terms of time-adjusted dollars. The MAPI method offers a framework in which to think so that everything that has a dollar value—and thus influences a replacement decision—will be accounted for. Two approaches within the MAPI framework have been developed by the author: one for large-volume work and automatic computers, the other for small-volume work and hand calculation.

Annual functions are used, as in the MAPI ap-

proach. Continuous functions could be used in the same way but they would involve more complicated mathematics. Also, it is easy to think in terms of annual compounding of interest and annual determination of the cost of retaining a piece of equipment. No new concepts are required since equipment replacement decisions are usually made once a year.

It must be remembered that interest that would have been earned by capital, had the investment not been made in equipment, must be included as a cost. For equipment that has some current value, the loss in salvage value over the same n-year period (see box of nomenclature) must also be included as a capital cost.

Therefore, capital costs at the end of n years include accumulated interest:

$$(1 + i)^n E - E$$

and loss in salvage value:

$$E - S_n$$

It is assumed that $S_0 = E$.

These two costs are combined in a term called "annual time-adjusted capital cost," C_n. The term adjusts these costs to an equivalent annual basis even though they are computed for a period of n years. The sum of the costs is:

$$(1 + i)^n E - S_n$$

To reduce this sum to an equivalent annual cost (the annual payment of a level annuity whose present worth is equal to present worth of the sum), it must be divided by:

$$1 + (1 + i) + (1 + i)^2 + \ldots\ldots\ldots + (1 + i)^{n-1}$$

This finite geometric progression can be summed as:

$$\frac{(1 + i)^n - 1}{i}$$

If the previously indicated division is carried through:

$$C_n = \frac{i\,[(1 + i)^n E - S_n]}{(1 + i)^n - 1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

At first, salvage value will be neglected and it will be assumed that $S_n = 0$. This assumed condition simplifies the thinking, but will be dropped later to more accurately depict actual conditions. Equation 1 then becomes:

$$C_n = \frac{i(1 + i)^n E}{(1 + i)^n - 1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Operating inferiority is the penalty in dollars for retaining a specific piece of equipment as compared to the most efficient replacement available. It reflects the influences of deterioration and obsolescence. The basic assumption is made that operating inferiority accumulates at a constant rate each year. This rate is the inferiority gradient, G. Assuming there is no operating inferiority during the first useful year of a machine, it can be seen that the time-adjusted operating inferiority at the end of n years is:

$$G(1 + i)^{n-2} + 2G(1 + i)^{n-3} + \ldots\ldots + (n-1)G$$

This series can be summed by repeated application of the geometric progression formula to yield:

$$\frac{G}{i}\left[\frac{(1 + i)^n - 1}{i} - n\right]$$

To obtain the equivalent annual cost of operating inferiority, this expression is divided, as was that for capital costs, by:

$$\frac{(1 + i)^n - 1}{i}$$

and yields

$$I_n = \frac{G}{i}\left[1 - \frac{ni}{(1 + i)^n - 1}\right] \quad \ldots\ldots\ldots\ldots\ldots (3)$$

The sum of capital costs and operating inferiority, both time-adjusted, is called the adverse average.

Nomenclature

$A_{N'}$ = adverse minimum; the smallest adverse average, obtained when machine is held for the optimum number of years

A_n = adverse average; annual time-adjusted sum of capital cost and operating inferiority for n years

C_n = annual time-adjusted capital cost of holding machine for n years

E = initial cost of equipment

G = constant inferiority gradient; the amount by which operating inferiority accumulates on machine each year

i = prevailing rate of interest

I_n = annual time-adjusted operating inferiority of machine, accumulated over n years

L = annual drop in salvage value

m = exponential decay factor

N = mathematical service life

N' = optimum number of years to hold machine; service life integer closest to N

n = number of years the equipment is held

n_0 = initial approximation of N

n_1 = improved approximation of N

p = percentage by which salvage value falls each year

s = value of machine when put in service, as percentage of initial investment

S_n = terminal salvage value of machine after n years

It is within this term that equipment efficiency and financial conditions are first related. An expression for the adverse average is found by adding Equations 2 and 3:

$$A_n = \frac{Ei}{1-(1+i)^{-n}} + \frac{G}{i}\left[1 - \frac{ni}{(1+i)^n - 1}\right] \quad \ldots\ldots\ldots(4)$$

Since

$$\frac{Ei}{1-(1+i)^{-n}} - \frac{Ei}{(1+i)^n - 1} = Ei$$

Equation 4 can be rewritten:

$$A_n = Ei + \frac{G}{i} + \frac{Ei - nG}{(1+i)^n - 1} \quad \ldots\ldots\ldots(4a)$$

This form effectively separates the accumulated interest component of capital cost from the loss in salvage value component since the equivalent annual cost of interest on the initial investment is Ei, independent of n.

It should be noted that A_n is a discrete function of n, since n has been restricted to integral values. Divorced from the text, however, A_n qualifies as a continuous function and may be minimized by setting its partial derivative with respect to n equal to zero. Equation 4a is convenient for this purpose:

$$\frac{dA_n}{dn} = \frac{[(1+i)^n - 1]G + (nG - iE)(1+i)^n \log_e(1+i)}{[(1+i)^n - 1]^2}$$

Since $(1+i)^n - 1$ is always positive and non-vanishing, setting the derivative equal to zero results in the following equation for N, N being that value of n for which A is a minimum:

$$(1+i)^N = \left[1 + \frac{Ei}{G}\log_e(1+i) - N\log_e(1+i)\right]^{-1}$$

Inasmuch as

$$1 + \frac{Ei}{G}\log_e(1+i)$$

is a constant, completely defined by the statement of the problem, it can be replaced by K for simplicity. The final implicit equation[1] for N is then:

$$(1+i)^N = [K - N\log_e(1+i)]^{-1} \quad \ldots\ldots\ldots(5)$$

which may be written:

$$N = \frac{1}{\log_e(1+i)}\left[K - (1+i)^{-N}\right] \quad \ldots\ldots\ldots(5a)$$

Since

$$\log_e(1+i) = i - \frac{i^2}{2} + \frac{i^3}{3} - \ldots\ldots\ldots$$

To a first approximation, $\log_e(1+i) = i$. By substituting this approximation in Equation 5, the following approximate equation is derived:

$$(1+i)^N = (K - Ni)^{-1} \quad \ldots\ldots\ldots(6)$$

which may be written:

$$N = \frac{1}{i}\left[K - (1+i)^{-N}\right] \quad \ldots\ldots\ldots(6a)$$

Equations 5a or 6a can be solved by the method of successive approximations. A guess is initially substituted for N on the right-hand side of the equation and a new and closer approximation to N is obtained from the left-hand side. The improved value for N is then substituted into the right-hand side. This process is repeated until two successive values of n agree within the desired accuracy.

Initial guesses can be based on experience in practical cases or can result from a short preliminary calculation. If the series expansions for $\log_e(1+i)$ and for $(1+i)^{-N}$ in Equation 5a are truncated after the second-degree terms, an approximation for N can be obtained easily:

$$n_0 i - \frac{n_0 i^2}{2} = K - \left[1 - n_0 i + \frac{n_0 i^2(n_0+1)}{2}\right]$$

which simplifies to:

$$n_0 = \frac{1}{i}\sqrt{2(K-1)} \quad \ldots\ldots\ldots(7)$$

Equation 7 provides a good first estimate for N so long as Ni is less than, or not much greater than, 1. For a still closer approximation, n_1, the series expansion $(1+i)^{-N}$ and $\log_e(1+i)$ may be carried out to their third-order terms. The cost of this additional accuracy for the first estimate is a cumbersome cubic equation. A close estimate of this cubic can be obtained, however, in terms of n_0 from Equation 7, by deriving an expression with the Newton-Raphson approximation formula. This equation:

$$n_1 = \frac{2n_0(n_0 i - 3)}{3(n_0 i - 2)} \quad \ldots\ldots\ldots(8)$$

is valid only for the value of n_0 and cannot be used with any other estimate of N, even though such estimate is closer to the actual value of N than is n_0.

Another method for obtaining an initial approximation for N is through use of Terborgh's short-cut formula:

$$n_0 = \sqrt{\frac{E}{G} + \frac{iE - G}{2G}}$$

This is obtained by use of simple instead of time-adjusted averages for capital cost and operating inferiority.

With a first estimate for N, either of two approaches can be used to determine service life and the minimum value of the adverse average. In the first approach, an accurate decimal value for N is obtained by successive substitution in Equation 5a. In the second approach, the more easily obtained N' is used to obtain the adverse minimum through use of a table.

[1]Equations 4 and 5 have been derived in a different manner by E. C. Varnum, THE TOOL ENGINEER, June 1953, pages 70-74.

Approach I: An equation for the adverse minimum in terms of N, the exact solution to Equation 5, can be derived. After making $1 - (1 + i)^{-N}$ the common denominator of Equation 4, Equation 5 (without the simplifying term K) can be substituted in it. This results in

$$A_N = G\left(-\frac{1}{\log_e(1+i)} + \frac{1}{i} + N\right) \quad \ldots\ldots\ldots (9)$$

which can be written:

$$A_N = G\left(\frac{\log_e(1+i) - i}{i\log_e(1+i)} + N\right)$$

Replacing $\log_e(1 + i)$ by

$$i - \frac{i^2}{2}$$

in the numerator and by i in the denominator yields:

$$A_N = G\left(N - \frac{1}{2}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

In theory, Equations 9 and 10 may not give the exact adverse minimum because N is not the precise integral service life. In practice, the curve of A_n against n has a flat dip in the neighborhood of N. The true minimum of curve A_N will thus generally coincide to the desired accuracy with the adverse minimum, $A_{N'}$. For the same reason, the service life N' will be the integer closest to N. Even for the exceptional cases, the deviation will not significantly affect a replacement decision.

Incidentally, Equations 4 and 5 could be combined in such a way as to eliminate G instead of E. This would result in an equation for the adverse minimum, solvable without knowledge of G if the service life were known. It appears highly questionable, however, that the optimal life of a new machine could be validly estimated without information on how it is expected to deteriorate and approach obsolescence.

The steps in Approach I are:

- Determine initial estimate, n_0, from Equations 7 or 8, or by other means.
- Solve Equation 5a for several successive approximations until desired accuracy of N is achieved.
- Substitute the value for N in Equations 9 or 10 to obtain adverse minimum.

Approach II: If natural logarithmus are taken of both sides of Equation 5a:

$$N\log_e(1+i) = -\log_e[K - N\log_e(1+i)]$$

For the present purposes, it suffices to approximate $\log_e(1 + i)$ by i, producing the simpler form:

$$N = -\frac{1}{i}\log_e(K - Ni) \quad \ldots\ldots\ldots\ldots\ldots\ldots (11)$$

A first estimate for N is obtained as before. Several integers close to n_0 are substituted into the right-hand side of Equation 11, yield corresponding values for n on the left-hand side. That value of n, which is substituted on the right, that most closely equals its related left-hand value is the desired service life, N'.

In place of this method, Equation 5a can be used to determine N'. This enables the use of an actuarial interest table instead of a natural log table. (If neither is available, natural logs can be found from: $\log_e x = 2.303\log_{10}x$.) The exact adverse minimum is obtained by substituting the value of N' in Equation 4. The value for N' must not be substituted in Equations 9 or 10 since these equations are valid only for values of N.

To avoid the laborious calculation necessary for direct substitution of N' in Equation 4, a table can be prepared to supply the E and G coefficients for a range of integral years at the given interest rate. The accompanying table provides these coefficients for a range of years from 1 to 70 at an interest rate of 10 percent. The first, second and third columns

Tabular Values for Finding the Adverse Minimum—Approach II

$(i = 0.10)$

n	E Coefficient $\frac{i}{1-(1+i)^{-n}}$	$\frac{i}{(1+i)^n-1}$	$\frac{ni}{(1+i)^n-1}$	G Coefficient $\frac{1}{i}\left[\frac{ni}{(1+i)^n-1}\right]$
1	1.10000	1.00000	1.00000	0.00000
2	0.57619	0.47619	0.95238	0.47620
3	0.40211	0.30211	0.90633	0.93670
4	0.31547	0.21547	0.86188	1.38120
5	0.26380	0.16380	0.81900	1.81000
6	0.22961	0.12961	0.77766	2.22340
7	0.20541	0.10541	0.73787	2.62130
8	0.18744	0.08744	0.69952	3.00480
9	0.17364	0.07364	0.66276	3.37240
10	0.16275	0.06275	0.62750	3.72500
11	0.15396	0.05396	0.59356	4.06440
12	0.14676	0.04676	0.56112	4.38880
13	0.14078	0.04078	0.53014	4.69860
14	0.13575	0.03575	0.50050	4.99500
15	0.13147	0.03147	0.47205	5.27950
16	0.12782	0.02782	0.44512	5.54880
17	0.12466	0.02466	0.41922	5.80780
18	0.12193	0.02193	0.39474	6.05260
19	0.11955	0.01953	0.37145	6.28550
20	0.11746	0.01746	0.34920	6.50800
21	0.11562	0.01562	0.32802	6.71980
22	0.11401	0.01401	0.30822	6.91780
23	0.11257	0.01257	0.28911	7.10890
24	0.11130	0.01130	0.27120	7.28800
25	0.11017	0.01017	0.25425	7.45750
26	0.10916	0.00916	0.23816	7.61840
27	0.10826	0.00826	0.22302	7.76980
28	0.10745	0.00745	0.20860	7.91400
29	0.10673	0.00673	0.19517	8.04830
30	0.10608	0.00608	0.18240	8.17600
31	0.10550	0.00550	0.17050	8.29500
32	0.10497	0.00497	0.15904	8.40960
33	0.10450	0.00450	0.14850	8.51500
34	0.10407	0.00407	0.13838	8.61620
35	0.10369	0.00369	0.12915	8.70850
40	0.10226	0.00226	0.09040	9.09600
45	0.10139	0.00139	0.06255	9.37450
50	0.10086	0.00086	0.04300	9.57000
55	0.10053	0.00053	0.02915	9.70850
60	0.10033	0.00033	0.01980	9.80200
65	0.10020	0.00020	0.01300	9.87000
70	0.10013	0.00013	0.00910	9.90900

of this table are in the appendix of *Principles of Engineering Economy* (E. L. Grant) and in other actuarial references. Columns four and five can be computed quickly and simply from the first three columns. Similar tables, for other interest rates already tabulated in some references, can be established in the same way.

Once the E and G coefficients are selected from the table, multiplication of E by its coefficient, G by its coefficient, and addition of these products gives the exact adverse minimum. No knowledge of E or G is necessary when constructing the table. The E and G coefficients could have forms other than those dictated by Equation 4. Equation 4a could be used, for example.

Sample Problem: Considering a machine with an initial cost of $5000 and an inferiority gradient of $100, with an interest rate of 10 percent, certain terms can be evaluated immediately:

$$\log_e(1+i) = 0.0953$$

$$\frac{1}{\log_e(1+i)} = 10.493$$

$$K = 1 + \frac{Ei}{G}\log_e(1+i) = 1.4765$$

Using Approach I (numbers in parenthesis refer to the equation that is used):

(7) $n_0 = 10\sqrt{0.953} = 9.76$

(8) $n_1 = \dfrac{19.52(-2.024)}{3(-1.024)} = 12.85$

(5a) $n_2 = 10.493(1.4765 - 0.2936) = 12.41$

$n_3 = 10.493(1.4765 - 0.3065) = 12.28$

$n_4 = 10.493(1.4765 - 0.3103) = 12.24$

$n_5 = 10.493(1.4765 - 0.3115) = 12.22$

(9) $A_N = 100(-10.493 + 10 + 12.220) = \$1173$

(10) $A_N = 100(12.22 - \frac{1}{2}) = \$1172$

The result of Equation 9 is exact, while that of Equation 10 is approximate. In accord with its definition, $N' = 12$ years.

Using Approach II:

(7) $n_0 = 9.76$

(5a)	^{n}right	^{n}left	
	10	11.45	
	11	11.82	
	12	12.15	←
	13	12.45	

From the table, the coefficient of E is found (for 12 years) to be 0.14676 and that for G is 4.3880

$$A_N = 0.14676(5000) + 4.38880(100) = \$1173$$

This sample problem was taken from *Dynamic Equipment Policy* and the same results are achieved, a service life of 12 years and an adverse minimum of $1173.

Salvage Value: Since the assumption of zero salvage value is not correct, the effects of this value should be included. Equation 1 can be rewritten:

$$C_n = Ei + \frac{(E - S_n)i}{(1+i)^n - 1} \qquad (1a)$$

where the first term is due to accumulated interest and the second term reflects the decline in salvage value. Three types of decline in value will be discussed: straight-line decline (or depreciation in a restricted sense), exponential decay and declining balance.

With straight-line decline, S_n takes the form:

$$S_n = E - nL \qquad (12)$$

where L is the annual drop in salvage value. Equation 1a then takes the form:

$$C_n = Ei + \frac{inL}{(1+i)^n - 1}$$

and Equation 4a becomes:

$$A_n = Ei + \frac{G}{i} - \frac{n(G - Li)}{(1+i)^n - 1}$$

The last term can be written:

$$\frac{G - Li}{i + \dfrac{n-1}{2}i^2 + \cdots}$$

which decreases monotonically as n grows from zero to large positive values. Therefore, A_n is also a monotonic function with a minimum at one of its extremities, and the problem is no longer meaningful. It is apparent that straight-line depreciation does not provide a pattern of decline for C_n that is compatible with the MAPI method.

For exponential decay, S_n takes the form:

$$S_n = sEe^{-mn} \qquad (13)$$

where m is the exponential-decay factor and s is the percentage of the initial investment at which the machine is valued when it is first put in operation. Equation 1a becomes:

$$C_n = Ei + \frac{Ei(1 - se^{-mn})}{(1+i)^n - 1}$$

An expression for A_n can be written and the analysis carried out as in the no-salvage case. However, since discrete functions have been used rather than continuous functions, it appears inconsistent to carry continuous depreciation any further at this time.

Declining balance provides a close approximation

to exponential decay in many practical problems and does fit the framework of the MAPI method. With declining balance, S_n assumes the form:

$$S_n = (1 - p)^n E \quad \ldots\ldots(14)$$

where p is the percentage by which the salvage value falls each year.

Equation 1a becomes:

$$C_n = Ei + \frac{Ei[1 - (1 - p)^n]}{(1 + i)^n - 1}$$

Equation 4a becomes:

$$A_n = Ei + \frac{G}{i} + \frac{Ei\,[1 - (1 - p)^n] - nG}{(1 + i)^n - 1} \quad (15)$$

Continuing the derivation as before and setting

$$\frac{dA_n}{dn} = 0$$

which yields:

$$0 = -[(1 + i)^N - 1]\,[Ei(1 - p)^N \log_e(1 - p) - G]$$
$$-(1 + i)^N \log_e(1 + i)\,[Ei - Ei(1 - p)^N - NG]$$

from which:

$$N = \frac{1}{\log_e(1 + i)}\left[K - (1 + i)^{-N}\right] + \frac{Ei}{G}(1 - p)^N \frac{\log_e(1 - p)}{\log_e(1 + i)} - \left(\frac{1 - p}{1 + i}\right)^N \frac{\log_e(1 - p)}{\log_e(1 + i)} - (1 - p)^N \Bigg] \quad \ldots\ldots(16)$$

The first term on the right-hand side of Equation 16 is the expression that was obtained for N in the no-salvage case. Furthermore, the term:

$$(1 - p)^N \frac{\log_e(1 - p)}{\log_e(1 + i)}$$

is negative, since $(1 - p)$ is between 0 and 1, and is just slightly larger numerically than the positive term:

$$-\left(\frac{1 - p}{1 + i}\right)^N \frac{\log_e(1 - p)}{\log_e(1 + i)}$$

for N sufficiently large and i sufficiently small. These terms may be considered to cancel each other out, leaving as the approximate equation for N:

$$N_D = N_Z - \frac{Ei}{G}(1 - p)^{N_D} \quad \ldots\ldots(17)$$

where N_D is the N for declining-balance salvage, and N_Z is the N for zero terminal salvage.

From Equation 17, it can be seen that a significant difference can be expected between N_D and N_Z when the second term on the right-hand side is large; that is, when p or N_D is sufficiently small. Since the second term of the right side of Equation 16 is always negative, it can be concluded that the assumption of zero terminal salvage value lengthens the service life of a machine. This observation applies only to the declining-balance hypothesis. The assumption of zero terminal salvage value will always provide for a higher adverse minimum, regardless of the salvage model assumed.

The declining-balance model can be substantiated by reconsideration of the sample problem. Terborgh has done this, in *Dynamic Equipment Policy*, by tabulating reasonable salvage values over a 15-year period without a fixed pattern. His salvage values may be approximated by a declining model with $p = 0.16$. Assuming N to still be on the order of 10, the second term of Equation 17 will be about 1 and N_D would not be equal to N_Z. Solving Equation 16 and rounding to the nearest integer, n, results in a service life of 9 years. Substituting this value into Equation 15 results in an adverse minimum of:

$$A_{N'} = 500 + 1000 + \frac{500(1 - \frac{1}{5}) - 900}{2.36 - 1} = \$1132$$

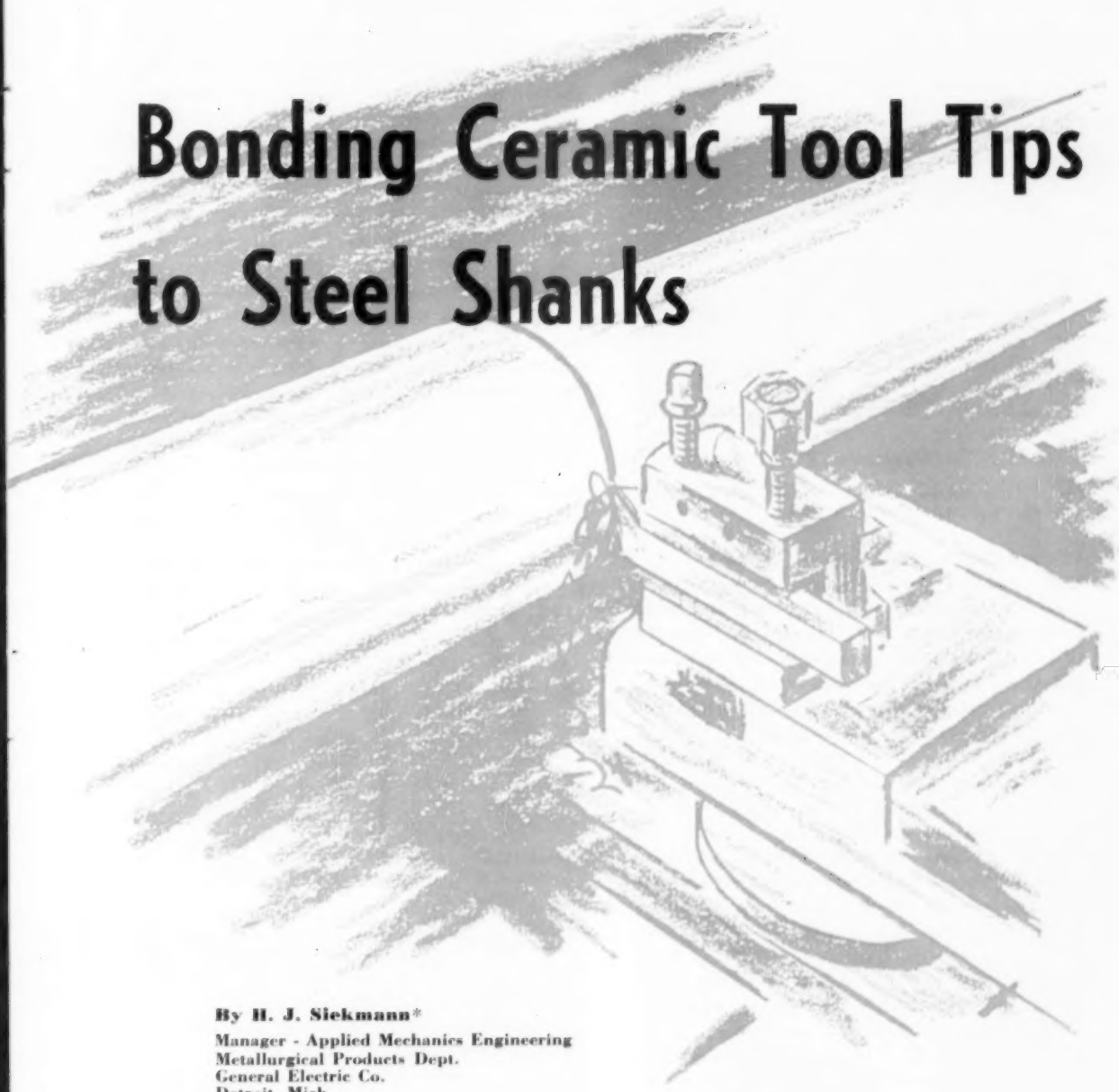
These results check exactly with those of Terborgh, but without the laborious year-by-year procedure.

With these formulas, and an understanding of their uses, machinery replacement decisions can be more effectively made with less effort. Tool engineers must now, more than ever, obtain the best returns possible from equipment dollars invested.

"How do you want this John, on the high side or low side?"

—Courtesy, Industrial Quality Control

Bonding Ceramic Tool Tips to Steel Shanks



By H. J. Siekmann*

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Can ceramic cutting tips be bonded to steel tool shanks with epoxy cements? Based on extensive tests conducted by General Electric engineers, the answer is yes. The author describes these tests and tells how epoxy resins are applied as bonding agents.

MECHANICAL HOLDERS provide a satisfactory means of fastening ceramic tool tips to steel shanks for most cutting applications. In the case of precision boring operations or complicated tooling setups, however, bonded, rather than mechanically fastened tips may be preferred. Unlike carbides, ceramics cannot be brazed unless the ceramic is first metallized. This intermediate process is expensive and the joints often fail in service, due to brazing strains caused by the different coefficients

*Senior member ASTE Detroit chapter.

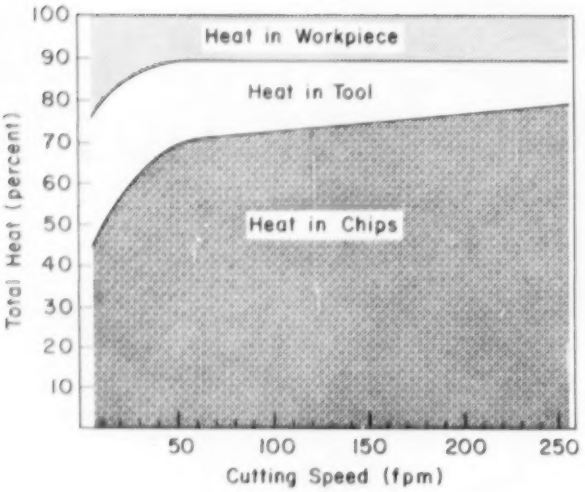

Fig. 1. Distribution of heat in work, tool and chips at various speeds.

of expansion of steel and ceramics.

Most cements loosen or break down during cutting. Ideally, a material for bonding a ceramic tip to a steel shank must have sufficient strength to hold up under the stresses of cutting operations and should not melt or break down at the temperatures normally encountered in cutting. An added requirement is that the bonding material should be capable of application at relatively low temperatures.

In evaluating various cements, epoxy resins appeared to be worth investigating. Although the strength of epoxy resins decreases rapidly with increasing temperature, it was felt that the ceramic would not transmit sufficient heat to the bond area to cause the resin to soften or decompose. Ceramic tools consist mostly of aluminum oxide, an insulating material whose coefficient of thermal conductivity is 50 percent that of carbide tooling materials. Thus cutting heat is concentrated at or near the cutting edge of the tool. Further, ceramic tools are most economically run at high speeds. At these speeds, *Fig.* 1, a smaller percentage of the heat generated in cutting goes into the tool.

Temperature Measurements: The apparent advantages of epoxy cements were put to test in a series of laboratory experiments. The first problem to be solved was the development of a method for measuring temperatures in the tool tip. The tool-work thermocouple technique was not suitable for this purpose, since ceramics do not conduct electric current. Ultimately, temperature-sensitive paints were utilized. They were particularly useful since they made it possible to measure temperatures in the area adjacent to the steel shank.

A comparison between cutting temperatures in a carbide tip and a ceramic tip, *Fig.* 2, confirmed the thermal insulation properties of ceramics. It will be noted that the isotherm on the flank of the carbide tool at 347 F drops into the bond area, while for the ceramic tool the 311 F isotherm is well out of the bond area. The carbide tested was a hard-finishing grade which, as carbides go, was low in thermal conductivity. Both tools were tested at 1000 fpm on AISI 1045 steel, with 0.005-ipr feed and 0.100-inch depth of cut.

Bonding Methods: Further experimental work was undertaken to establish satisfactory bonding materials and methods. Two epoxy resins were investigated: a dry powdered resin and a resin which comes in paste form, *Fig.* 3. Both of these materials gave good results in experimental tests.

The powder softens at approximately 200 F and cures or hardens permanently when heated above 270 F for a sufficiently long period. It was discovered that best results are obtained when both the steel shank and the ceramic tip are grit-blasted prior to the application of the powder. Grit-blasting of the tip must be carried out at relatively low velocity to avoid damage. The shank and tip are then cleaned with a suitable solvent to remove

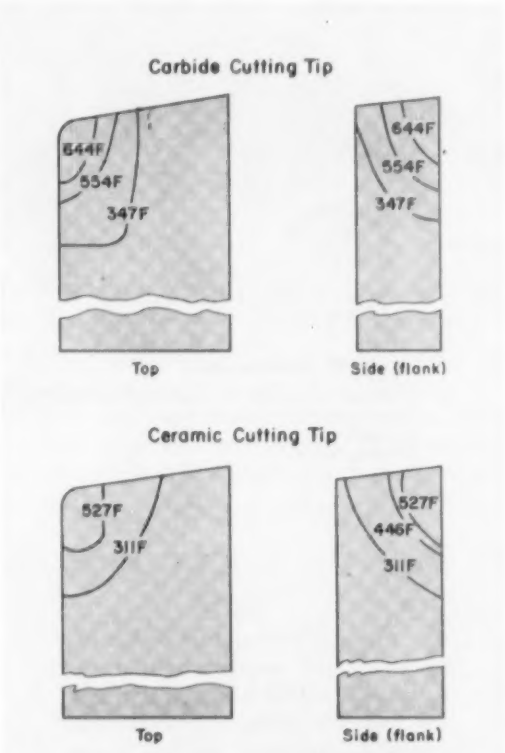

Fig. 2. Heat distribution in carbide and ceramic cutting tool tips after equilibrium conditions have been established. Both tools were run under the same conditions.

all oil and grease.

When bonding the tip to the shank, a quantity of powdered resin is placed in the shank recess. The shank is then heated to a temperature of 250 to 300 F, causing the powder to melt. The ceramic tip, which has also been heated, is then worked into place. Generally, it is advisable to place wires or shims between the tip and the shank to provide a clearance of from 0.001 to 0.003 inch, *Fig.* 4. This assures adequate bond thickness.

When the powder is applied, the shank must be warm enough to fully melt the powdered resin, or the resulting bond will be weak. If the shank is too hot, however, the resin will decompose—a condition indicated by bubbling or smoking—and the final bonding strength will not be satisfactory.

Curing is accomplished by heating the assembly in an oven at 340 F for four hours, or at 270 F for a minimum of ten hours, *Fig.* 5. At these temperatures there is practically no danger of overcuring. To remove the tip for replacement, the assembly is slowly heated to approximately 700 F. The tip can then be readily pried loose.

Paste type epoxy cements are more convenient to use than powder types, since they can be applied to cold surfaces. The shelf life and aging characteristics of paste cements, which were placed on the market only recently, are unknown.

As is the case with powder adhesives, the tip and shank must be grit-blasted and cleaned before application of paste cements and use of shims is advisable. After positioning the shims, the paste is applied to the cold shank and the tip is placed in the shank recess. This is done carefully to avoid formation of air bubbles. Curing is accomplished by heating the assembly in an oven at 340 F for four hours.

Cutting Tests: Because of the thermal insulation properties of ceramics, there is a direct relation between the thickness of the cutting tip and the amount of heat transmitted to the tip-shank interface. Two tip thicknesses, $\frac{1}{8}$ and $\frac{1}{4}$ inch, were evaluated under various cutting conditions. Three shank sizes were also tested to determine the effect of shank cross-section on the withdrawal of heat from the bond area.

All tests were run at 1000 fpm on AISI 1045 steel, Bhn 170-187. It was assumed that equilibrium conditions would be reached in a tip after nine to ten minutes and if no movement of the tip was noted after cutting for this length of time, the test was stopped. Some tests were run a few minutes longer to make sure that loosening would not take place.

As can be seen in the accompanying table, the $\frac{1}{8}$-inch-thick tips cemented to $\frac{3}{8}$-inch-square shanks with paste resin performed well up to feeds of 0.003 ipr at $\frac{1}{16}$-inch depth of cut. When the same

Fig. 3. (left) Positioning a ceramic cutting tip on a steel shank after applying an epoxy paste cement.

Fig. 4. (above) Grit-blasted shank and ceramic cutting tip ready for bonding. Shims are used to maintain clearances.

Fig. 5. Furnace for curing epoxy bond. Hardening occurs after four hours at 340 F.

size tip was fastened to ½-inch-square shanks with paste resin, it did not loosen at 0.004-ipr feed, indicating that there is some advantage to using the heavier shank. The tip did loosen, however, at feeds of 0.005 ipr.

Used with 1-inch-square shanks, the ¼-inch-thick tips cemented with paste resin did not come loose at the feeds tested and ⅛-inch depth of cut, but did break at feeds higher than 0.014 ipr. This exceeded the operating range of ceramic tools, which are not recommended for heavy cuts. The paste cements, however, held up at lower feeds.

Conclusions: It was apparent from the tests that with ¼-inch-thick tips little difficulty from bond failure will be encountered, provided that feed does not exceed 0.010 ipr and depth of cut does not exceed ⅛ inch. If failure of the tool from softening of the bond between tip and shank does occur, a good flood of coolant may solve the problem. Coolants apparently do not harm ceramic tool materials and help to keep the bond temperature well below the softening point.

Several production applications of epoxy-bonded ceramic cutting tips have been made. On one job, boring tools equipped with ⅛-inch-thick Grade 0-30 tips made cuts of 0.010-inch depth at 0.006-ipr feed on a highly abrasive material. The bond showed no indication of loosening. Good results were also obtained when boring an automotive cast-iron part. In this instance, 3/16-inch-thick Grade 0-30 ceramic tips were used and the epoxy bond held successfully, despite depths of cut ranging from 0.015 to 0.025 inch at feeds of 0.012 ipr. These results, along with the results of laboratory experiments, support the conclusion that epoxy cements are excellent materials for bonding ceramic cutting tools to steel shanks.

Epoxy Bond Evaluation Data

Tip Thickness (inch)	Shank Size* (inch)	Feed (ipr)	Depth of Cut (inch)	Results and Duration of Tests — Powdered Resin — Result	Powdered Resin — Time (min)	Paste Resin — Result	Paste Resin — Time (min)
0.125	0.375	0.002	0.0625	Loosened	1:15	—	—
0.125	0.375	0.003	0.0625	Loosened	0:10	OK	12:35
0.125	0.500	0.003	0.0625	Loosened	0:37	OK	9:30
0.125	0.375	0.004	0.0625	—	—	Loosened	0:50
0.125	0.500	0.004	0.0625	—	—	OK	—
0.125	0.500	0.005	0.0625	—	—	Loosened	—
0.250	1.000	0.006	0.125	—	—	OK	15:00
0.250	1.000	0.010	0.125	OK	8:15	OK	11:00
0.250	1.000	0.014	0.125	Loosened	1:00	OK	10:00
0.250	1.000	0.016	0.125	Loosened	9:45	Tool broke	2:45
0.250	1.000	0.018	0.125	Tool broke	1:10	Tool broke	0:55

*Square shanks were used for all tests.

Mounting Production Machine

to control vibration and simplify repositioning

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Photo courtesy Kearfott Co., Inc.

Fig. 1. All-metal mounts, bolted under the legs of a press, reduce transmission of vibrations to acceptable levels and maintain the press location without lagging.

Vibration mounts are finding increasing use as more accurate results are expected of machine tools. Modern, all-metal mounts prevent the vibrations of operating machines from influencing the accuracy of adjacent equipment.

Machine tools, surface grinders, presses, generators, pumps, fans, air conditioners and piping can all be sources or transmitters of disturbing vibrations and shocks. These disturbances can loosen machine parts, cause rough finishes on workpieces, result in wear of machine parts and fatigue operators unnecessarily.

Vibration is a complex phenomenon that can be defined simply as a periodic motion that takes place when an elastic system is displaced from its equilibrium position and released. There are six basic modes of vibration and they may occur singly or in any combination. The modes are translational and rotational along the vertical, lateral and longitudinal axes of equipment or machinery.

In a machine tool, vibration is usually translational in the vertical axis and may be excited by such vertical working components as the main ram or punch whose action is vertically up and down. A horizontally sliding arm or lever may create longitudinal and lateral motion that may be coupled with a vertical movement to cause the machine to rock and sway.

Causes of shock and vibration in and around machine tools are numerous. Generally, the motor, unbalanced fan belts or linkages, pulley wheels or gear teeth and clutches create vibration while the movement of working parts may account for shock, and some vibration and noise.

Whenever possible, causes of vibration should be removed even though vibration mounts will be used and will protect adjacent equipment. Nuts,

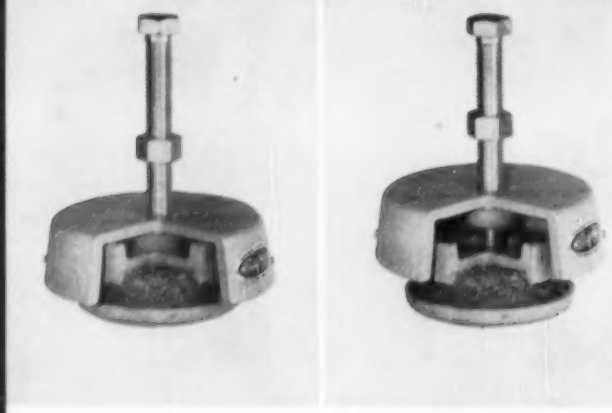


Fig. 2. Mounting units, fabricated from thousands of interlocking springs, can be adjusted for height by means of the center jackscrew to accommodate uneven floors.

Comparative Characteristics of Resilient Mounting Elements

Characteristic	Steel Springs Used Alone	Natural Rubber	Cork Mats	Met-L-Flex Cushions
Damping Performance (%)	½	2 to 5	6	15 to 20
Recommended Loading	tension compression	most flexible in shear compression	compression only	compression shear
Deterioration Causes	moisture acids	oil, sunlight, dirt, temperature extremes chemicals, fungus	acids, alkalies temperature extremes	none
Remarks	linear spring rate, shock attenuation	vibration isolation, sound isolation	good sound isolation	nonlinear spring rate, shock, vibration and noise attenuation

bolts, screws and loose couplings should be tightened. Misaligned shafts should be trued and worn bearings should be replaced. Vibration is normally present in gearing but excessive vibration occurs if center spacing of the gears is incorrect so that the teeth strike each other. Also, gears should be kept free of dirt. Poorly spliced or lumpy pulley belts should be replaced.

The all-metal machine-tool mount functions underneath machinery or equipment as a resilient support between the floor and the machine. One is usually placed under each corner or foot of the machine, *Fig.* 1, although additional mounts may be required to carry the total load. Proper application of machine mounts can avoid such costly alternatives as strengthening floors with concrete slabs, wooden piles or steel girders. Adequately mounted vibrating machinery has been installed on upper floors and near office spaces where vibrations could not be permitted.

The all-metal mounts that have made possible such installations are simple units usually no greater than 5 inches in diameter or 3 inches in height. Although these units are simple to apply, their design must be carefully considered. Equipment weight and mass, natural frequency and shock force, function, amount of damping required and spring-rate constant must all be heeded.

Materials such as cork, rubber and plain steel have been widely used. Cork is inexpensive and can be applied in large quantities. It is usually cut in strips or mats and applied to the machine base with a special cement. Rubber is excellent for mounting loads in shear but deteriorates on exposure to oil, chemicals and water. Steel springs can provide high deflection for shock forces but their damping characteristics are not sufficient to prevent the vibratory oscillation that may be more severe than the initial shock.

All-metal mounts are built up around cushions fabricated from thousands of interlocking stainless steel springs, *Fig.* 2. Other spring materials can be used where special conditions require different properties than exhibited by stainless steel. The spring cushion is formed and compressed precisely in a die to meet design requirements. An auxiliary helical spring can be included in the design of all-metal mounts. Characteristics of the various resilient materials are compared in the accompanying table.

Such factors as center of gravity and total equipment weight are basic when designing machine mounts. Where the weight of the machine is greater on one of the legs than the others, a high load-range capacity will be needed by the unit at that leg. This extra consideration is not limited to static compression loading. Overload capacity is required for mounts on machines where large, heavy workpieces may be run from one side of the table to the other, causing an alternating shift of weight from one leg to the other.

To avoid bottoming with cancellation of the mount action, it has been necessary to use elements with nonlinear characteristics. Overloads are given increased support, and vibration and shock attenuation. Although the safety factor of such mounts is usually called into play because of the weight and handling of the workpiece, applications on drop hammers are an exception. Drop hammers create a force over and above that of the dead weight of the machine. This force must be absorbed by the hammer mountings. On the other hand, punch-press forces are contained largely within the structure and the major factors affecting damping are the vibrations and the weight of the machine. Generally, shock forces of industrial machinery are of relatively small magnitude.

For vibration isolation, the disturbing frequency in cycles, revolutions or strokes per minute can be controlled by mounts whose natural frequency is

half the disturbing frequency. In low-speed operations, a disturbance is treated as repetitive shock and its frequency should be no more than half of the mount's natural frequency.

When more than one disturbing frequency is evident, as when a machine is driven at 800 strokes per minute by a speed reducer and a 1750-rpm motor, the most disturbing frequency must be determined by investigation. Quite frequently, the primary disturbance is directly traceable to the motor speed.

There are multiple operations during each stroke or cycle in some industrial machines. If these operations are equally spaced during each rotational cycle, the primary disturbance will have a value equal to the number of operations times the number of revolutions per minute. If the operations are intermittent, the frequency of the disturbance can be found by determining the time interval between operations and calculating the number of operations per second that would occur if the action were continuous.

Although the motor of an installation may be well balanced, disturbances can emanate from fan blades, pistons, linkages, etc. The frequency of such disturbances is normally the motor speed multiplied by the number of blades of the fan, operating strokes per revolution, or linkage motions times the rotational speed in revolutions per minute. In conventional 4-cycle combustion engines, disturbances will occur at frequencies equal to half the operating speed (when the firing stroke occurs), the operating speed, and half the number of cylinders multiplied by the operating speed. For a 2-cycle engine, disturbances will occur with frequencies equal to the operating speed and to the operating speed times the number of cylinders.

A typical installation in which vibration proved to be more of a problem than shock was a 60-ton punch press, *Fig.* 1, used by the Kearfott Co. Its operation was accompanied by shock that was followed by lingering vibration of a magnitude sufficient to interfere with the performance of sensitive inspection instruments and test machinery installed nearby.

The 9000-lb press, operating at 90 spm, was mounted on felt pads that had depressed from $\frac{3}{4}$ to $\frac{1}{4}$ inch in service and which had become saturated with oil. The felt pads were replaced with low, sandwich type metal mounts having ample top and bottom areas, *Fig.* 3. Five stainless-steel spring cushions were required in each mount to carry the machine load. These mounts, one of which was attached to each foot of the press, successfully controlled both shock loads and vibrations. The remounted machine operated without disturbing the delicate instruments and without moving from its position.

Such a problem is typical of those met in industrial areas that are close to railroad yards, truck routes and other sources of shock and vibration. Since modern machine tools are being engineered for greater accuracy and higher operating speeds, frequently with deeper cuts, extraneous vibrations must be isolated if good work is to be accomplished.

In another instance, the only drawback to the use of a toolroom jig and gage boring machine having an optical measuring device was the fact that the slightest vibration could upset the precision settings or blur the microscopic image. Without vibration, the lighted microscope could be read to an accuracy of 0.00005 inch and machine adjustments in the order of 0.0002 inch could be made. Unfortunately, this machine had been installed next to a 50-hp compressor and some tumbling equipment.

Vibrations from these two sources were more than enough to make accurate operation of the jig borer impossible, especially with its 26-inch table travel. Most of this vibrational disturbance had a frequency over 10 cps. All-metal mounts with natural frequencies of 7 to 10 cps were installed so the natural frequencies of the mounts would be lower than that of the disturbing vibrations. Reading of the optical sight was considerably improved and the machine could work, anywhere within the table travel, to its designed accuracy of 0.0002 inch.

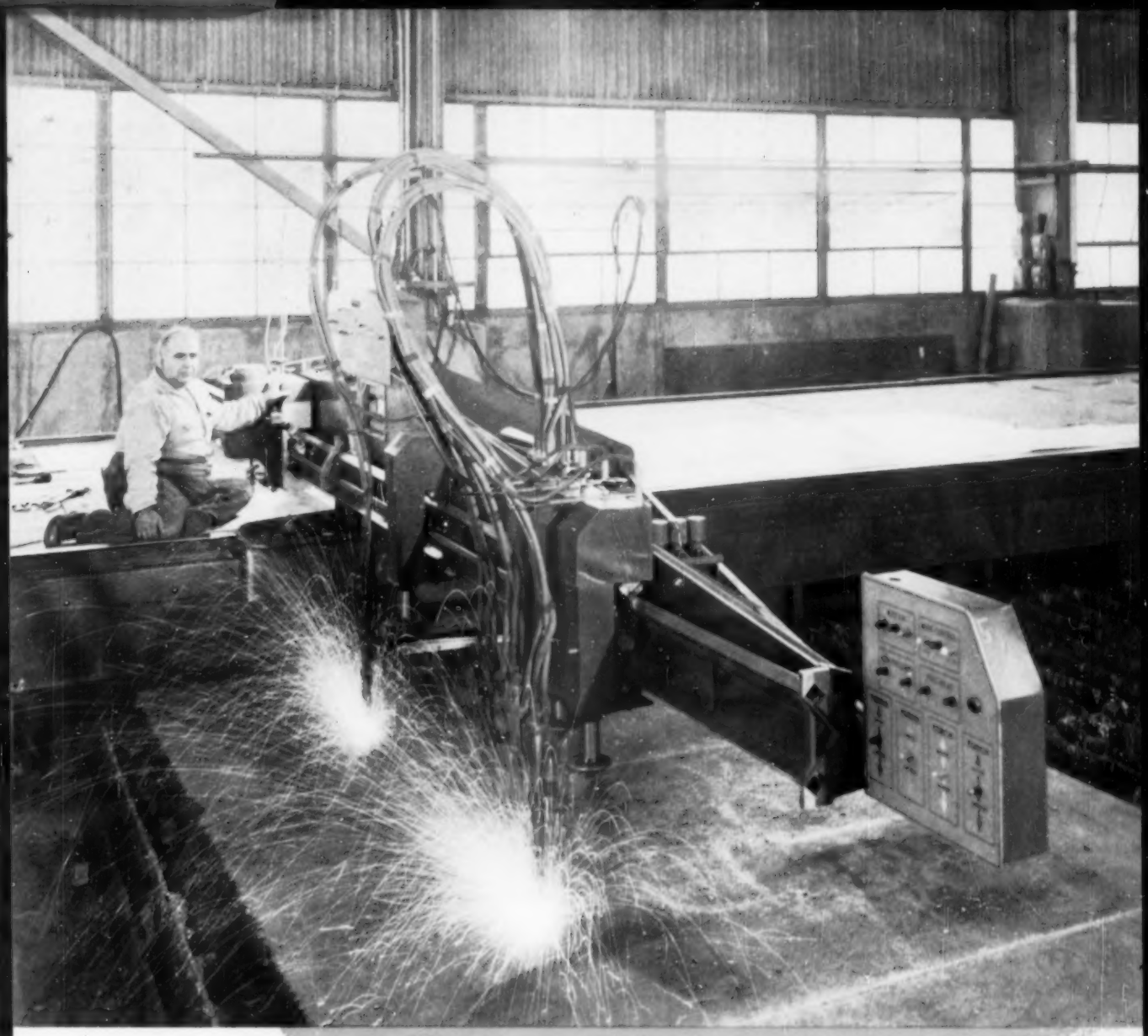
The best time to think about vibration mounting is when a machine is being designed or installed. With unit mounts, however, vibration problems can be minimized at any time. Special precision machinery may require individually engineered mounting systems. This is especially true when the machine must be carefully installed, leveled and lagged to insure accuracy. Structures of such machines must be inspected to determine if they are rigid enough to permit the use of resilient mounts. If they are not, they can be stiffened before installation.

Fig. 3. Sandwich-design mounts can be used where heavy loads, such as that of *Fig.* 1, must be handled.

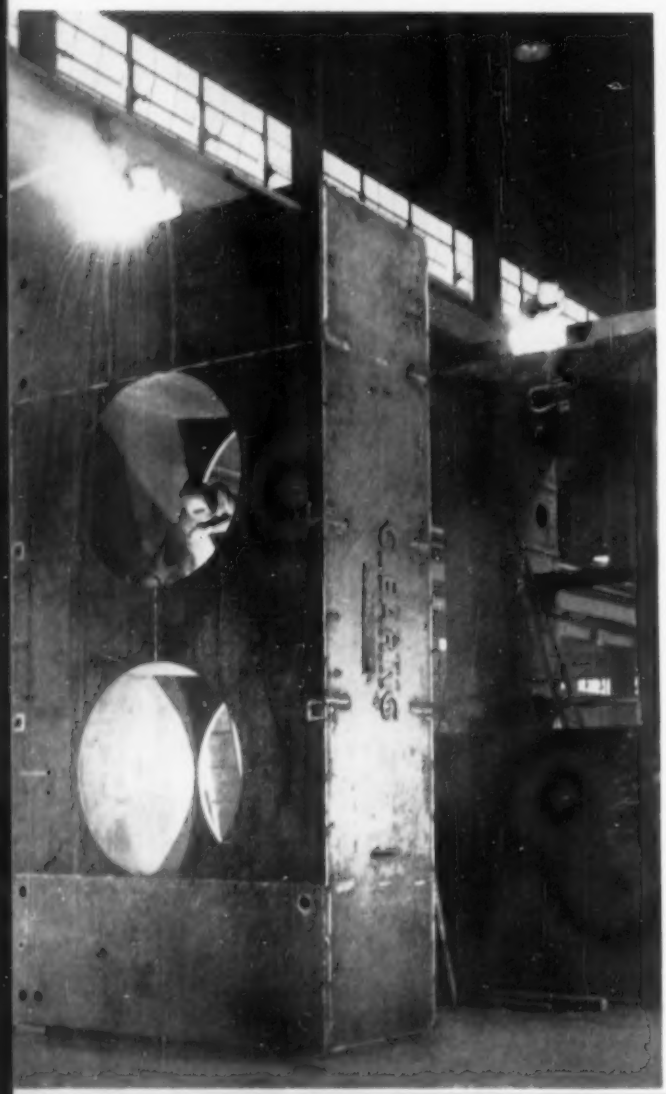
Down time for repairs on operating parts destroyed by vibration, and frequent and unnecessary maintenance problems caused by premature deterioration whittle away profits. Any machinery should be regarded as a potential source of vibrations. Vibrating machines should be fitted with mounts in self-protection and to protect equipment adjacent to them.

As specialists on metalworking problems, machine builders are seldom thought of as manufacturers. A variety of interesting and unusual techniques, however, may be found in such plants as that of the Clearing Machine Corp., Chicago, a major maker of large presses.

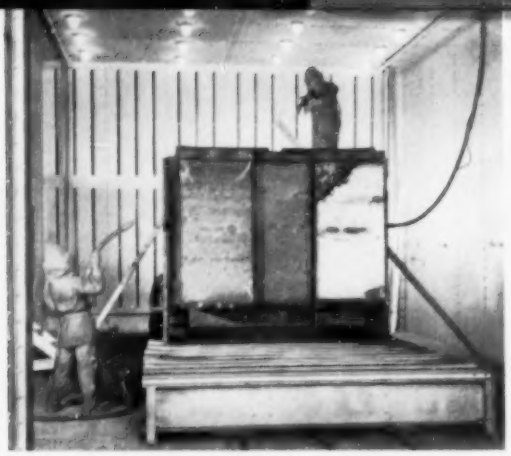
TOOLS at work



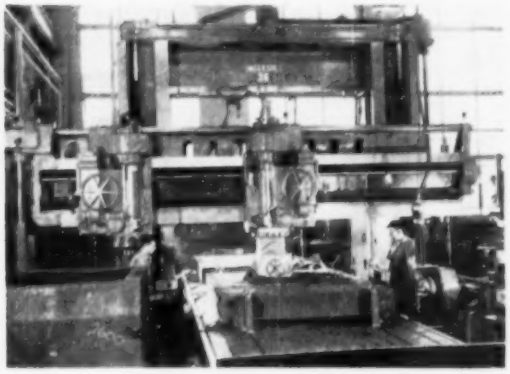
Manufacture of metalworking presses begins with large pieces of flat stock which are cut to size and shape in a semiautomatic operation. Full-scale paper templates guide the cutting torches. These templates are placed on a table at the side of the stock. An indicator moves over the pattern to direct the torches.



Press crowns take shape in the weld shop. The heavy steel plates are being arc welded together to form the frame component of a 1000-ton bottom drive press.

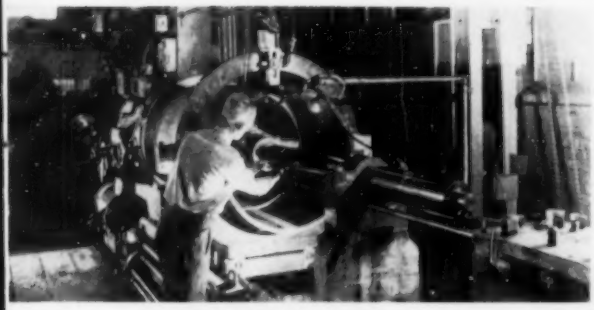


Clad like men from another planet, operators apply steel shot to components at over 100 psi in a special chamber. Added primarily to remove scale and weld splatter, this step assures greater accuracy and efficiency in machining weldments. The shot blast room is floored with perforated steel panels to gather spent shot.

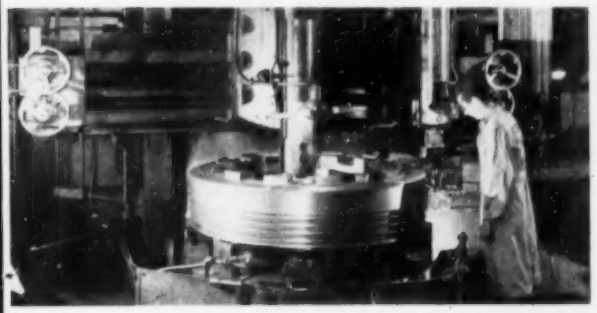


Simultaneous cuts are milled in a cast-iron bolster plate 90 x 180 inches. The HSS cutting heads are turning at 75 fpm, while moving over the surface at 8 ipm. The cuts are 1 1/16 inches in width and 2⅝ inches in depth.

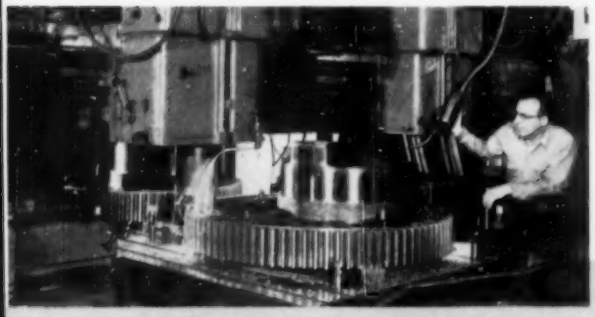
TOOLS at work



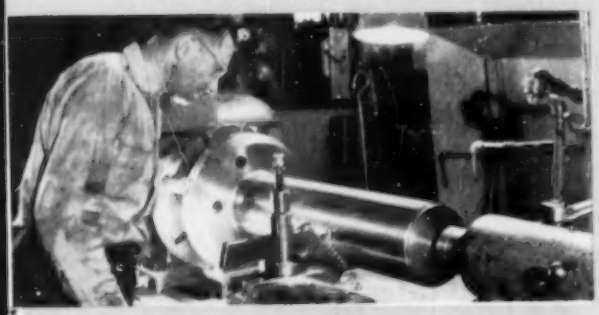
Counterbalance cylinders undergo two operations in one setup in special lathe. The ID of the cast-iron cylinder is bored to 34 inches, with a tolerance of 0.004 inch. The flanges are also faced.



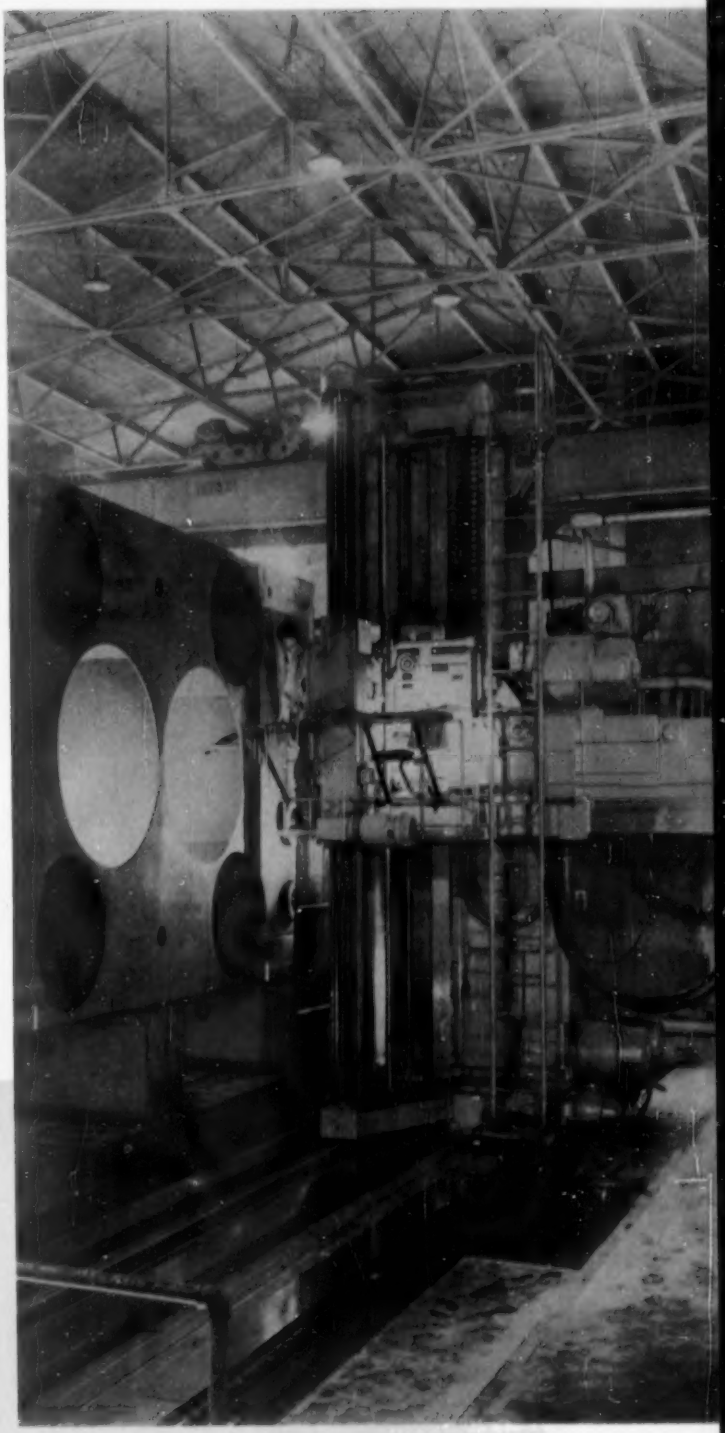
Flywheel has two operations performed on it simultaneously. The top head of the cast-iron workpiece is bored at 160 fpm with a HSS tool while V-grooves are cut with a carbide tool.



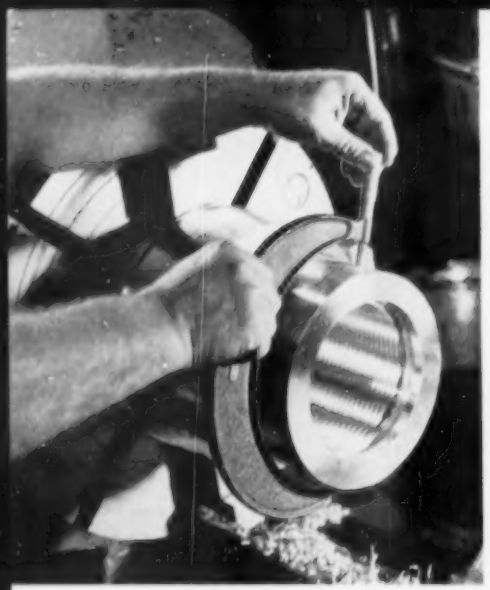
Machining an eccentric gear of cast steel. The shoulder is removed with a 10-inch HSS cutter operating at 20 rpm or 50 fpm. Feed varies between 5 and 10 ipm.



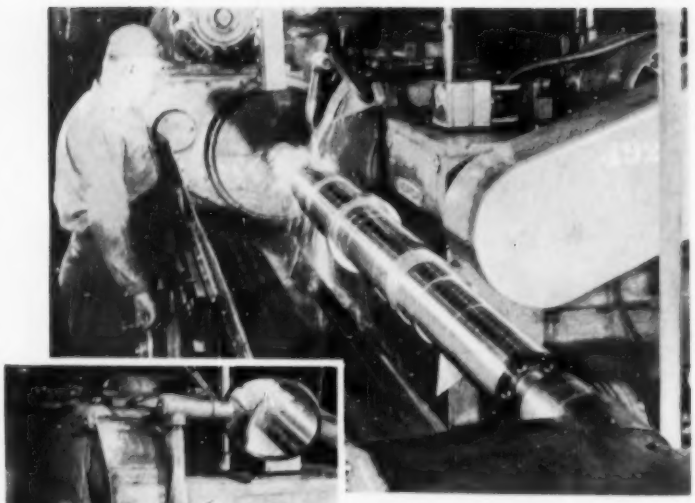
Cutting a buttress thread on a slide adjustment screw. The 1045 steel forging has an OD of 7½ inches. Threads, 3 per inch, are cut with a carbide tool.

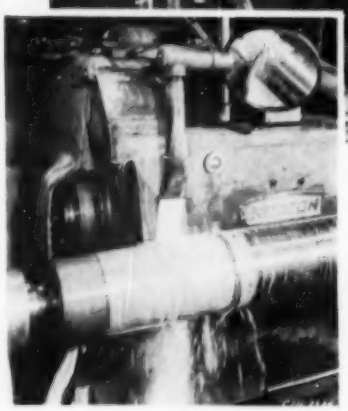


Counterbalance cylinder support is set up for boring and milling on a large G & L horizontal machine. For the operation a HSS boring bar is used at 60 fpm on the 1020 steel workpiece. Tolerances are plus or minus 0.005 inch.



Nut for slide adjustment is checked after machining. Operations performed in this one lathe include turn OD, face, bore and thread, saving duplication in setup time. The SAE 68 B aluminum bronze workpiece is cut by all carbide tools. The OD being checked must be to 0.001 tolerance of the 9¼-inch dimension.





Drive shaft is precision ground to finish it. This shaft is 7 inches in diameter and of 1045 steel. Tolerance on this operation is 0.0005 inch with a surface finish of 16 microinches achieved. Mirror aids operator (close-up) in observing cutting action.

TOOLS at work

Final step is mating of parts and components on the assembly floor. Assemblers are installing electrical controls on line of presses to be integrated into a single tranfer type unit.

redesign

simplifies processing of machine base

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and
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Design modification for tooling and production reasons can also pay dividends in a better product with advanced styling, as this case study drawn from industry demonstrates.

Fig. 1. Welding to assemble machine base has been simplified in redesigned unit.

DESIGNING TO IMPROVE producibility has simplified assembly and welding of a base for a cutter and tool grinding machine. Appearance was improved and tool costs were cut also. Originally of cast-iron construction, the base was first duplicated in welded steel, then completely restyled because of production difficulties with the weldment. The result was a 38 percent saving in manufacturing cost and greatly simplified welding procedure, *Fig.* 1.

Comparison of the old and new welded design is shown by exploded drawings, *Fig.* 2. Numerous inserts and small pieces required in the first concept, namely, *A*, *B*, *C* and *D*, were tedious to handle and weld. These pieces were eliminated, as were the block inserts, *E*, *G*, *H* and *I* in the top pan, which supports the cross slide.

Only six basic cut and formed sections make up the new design, along with seven small rectangular steel blocks which comprise the slide support. All are sheared and bent, or notched, dispensing with former nibbling and sawing operations. Sheet steel for sides, wings, lower pan and back panel was reduced to 10 gage with no sacrifice of strength, yielding a saving of 87 on material alone.

Time checks on the two designs indicated that the newer required only 12.306 allowed manufac-

Based on a prize-winning paper submitted in the recent Machine Design Competition sponsored by The James F. Lincoln Arc Welding Foundation.

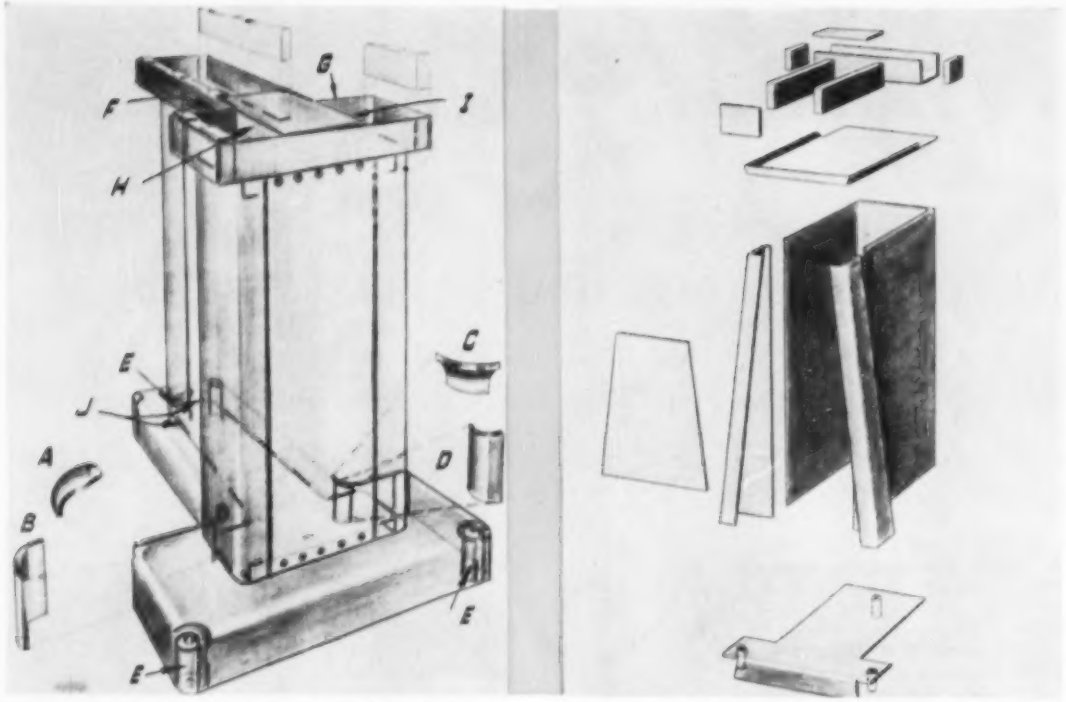

Fig. 2. Simple sheared, bent or notched sheet elements make up the new design at the right, contrasting sharply with the many small inserts which complicated welding of the first concept.

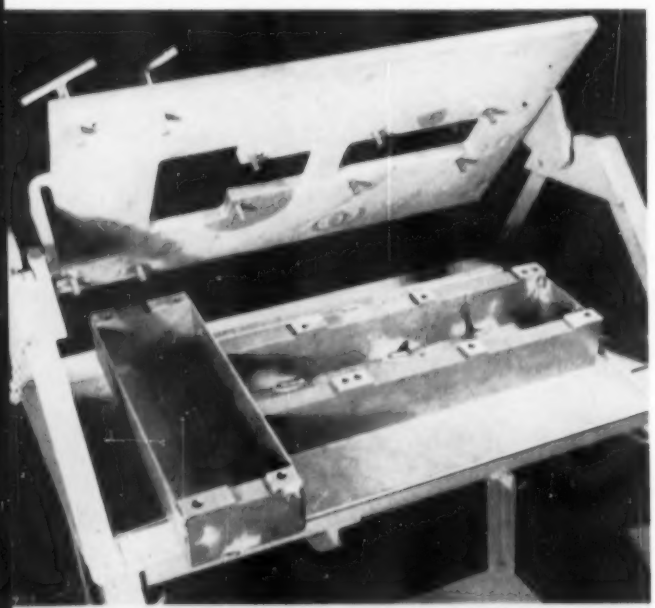

Fig. 3. Top pan assembly fixture shows low-cost tooling made possible by production redesign.

turing hours, against 20.761 for the old type. These, it should be noted, are incentive hours for pieceworkers; actual time consumed figured about 38 percent less in each instance.

Sequence of the basic steps and actual time involved for assembly and welding is as follows:

1. Place base plate on fixture. Height is maintained by assembling three tubular feet to fixture by screws. Tack weld feet to base plate. Elapsed time: 0.037 hour.
2. Place U-shaped front panel in position and weld to base plate with 2-inch tack welds. Elapsed time: 0.118 hour.
3. Position wings and tack weld. Complete corner weld from top to bottom. Elapsed time: 0.402 hour.
4. Clamp back plate in position and weld joints continuously. Elapsed time: 0.316 hour.
5. Grind surface irregularities from top edge to seat top pan squarely. Elapsed time: 0.024 hour.
6. Assemble cross slide bed mounting blocks and two table bed mounting blocks in top pan assembly fixture, *Fig.* 3. Pre-drilled holes and dowel pins locate top pan assembly. Weld blocks into position with 2-inch tacks. Outside corner welds are continuous. Reduce heat by applying wet shop towels after completion of each weld. Withdraw dowel pins and remove assembly. Elapsed time: 1.095 hours.

Comparison of Allowed Manufacturing Time for Old and New Designs

Part	No. Req'd	Allowed hours Old	New
Base, complete, incl. wrench rack	1	19.876	9.646
Base feet	3	0.528	0.288
Base compartment cover	1	0.277	0.277
Cross slide mounting block, Right	1	.. ..	0.726
Cross slide mounting block, Left	1	.. ..	0.725
Table bed mounting block	1	.. ..	0.932
Wheel puller retainer	1	.. ..	0.132
Screws	4	0.080	0.080
Total time		20.761	12.806
Incentive hours saving			7.944

7. Place top pan assembly on base weldment, aligning top milled surfaces horizontally with height gage. Adjust top plate with base by eye; tack weld. Assemble wrench rack parts, *Fig.* 4. Tack weld to pan. Release weldment from fixture, turn upside down and complete welding of top from inside. Finish weld bolt-down tubes to the base. Elapsed time: 0.555 hour.

After welding is completed, the base is removed for grinding and blending of the welds before prime painting. Only one machining operation is necessary, a skim milling cut to bring projections of the cross slide mounting blocks and table mounting blocks into alignment.

A breakdown of manufacturing time allowed for the original welded base and the restyled unit, based on incentive hours as mentioned previously, is shown in the accompanying table.

Less obvious advantages of the new design include: reduced worker fatigue because of a lighter unit; less grinding and blending of exposed welds; faster painting and filling because of elimination of corners and curves; fewer manufacturing errors and less rework because of more simply designed components; reduced demand on machine tools and handling equipment through elimination of most machining operations.

Over-all appearance of the redesign is more modern and functional by today's standards, *Fig.* 4, principally through discard of the traditional pedestal in favor of the tapered wing sides.

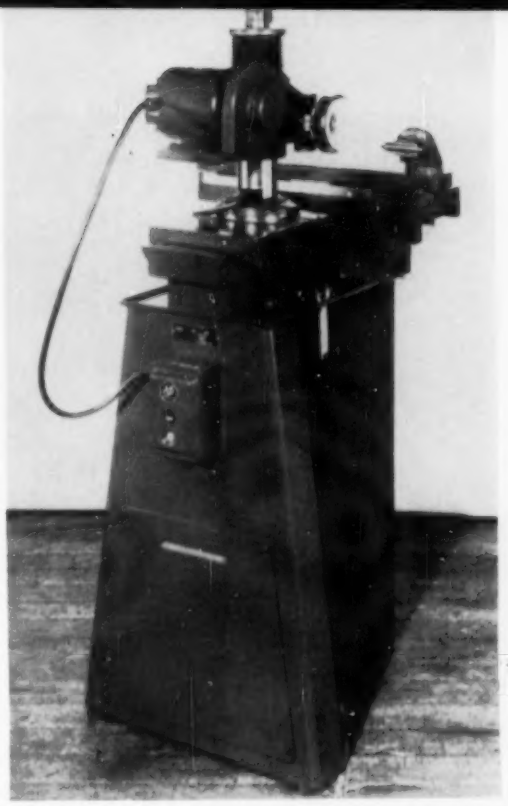

Fig. 4. Finished unit shows results of functional styling combined with simplified welding procedures for improved appearance and economy.

Mechanical Blackboard Aids Engineers

Shortcuts to answers to problems posed during industrial research, design or even programming may be provided by a new "mechanical blackboard". The device, designed and built by mathematicians and engineers in the Operations Research group of University of Michigan's Engineering Research Institute, is not a computer because it cannot "remember" instructions. However, an inexpensive unit as compared to a big electronic computer, it can add, subtract and perform other simple functions. By providing relatively quick answers it points the way to solutions. This assures more efficient use of conventional computers, according to Robert Machol, engineer who participated in the tool's development.

Face of the device, called MITAB (for Michigan Transportation and Assignment Blackboard), is made up of 400 indicators similar to those used to record mileage on an automobile, 800 lights and 400 switches. The indicators, each of which registers from 0 to 10, are arranged in 20 rows and 20 columns.

In a specific problem, the rows may represent the machines available for jobs in a factory, and the columns the various jobs to be done. The indicators can be set to show the cost of each job on each machine. Mr. Machol points out that with 20 jobs and 20 machines there are 2,432,902,008,176,640,000 possible ways to assign the jobs. The problem is to find the best arrangement interpreted by least total cost, fastest operating time or other criterion. The mechanical blackboard works automatically figuring, erasing, adding, subtracting, identifying elements, changing order of numbers etc. as an operator spins a telephone type dial, until best solution to the problem has been found.

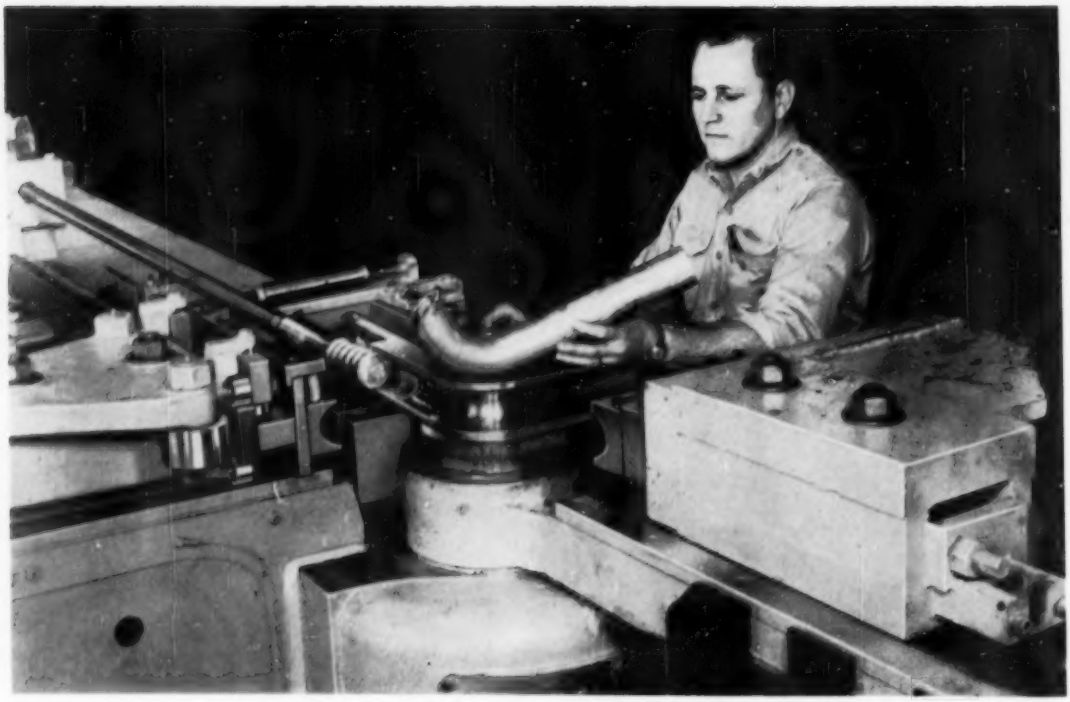

Fig. 1. Setup for cold bending thin-wall tubing. Machine is tooled with five-ball mandrel and has roller type pressure die, which travels with work through bending cycle.

COLD FORMING improves tubular parts

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The trend to cold forming is based on economic, production and design advantages as demonstrated in this case history from the aircraft field.

To take advantage of developments in cold forming, the Aircraft Components Division has revamped manufacturing procedure substantially. The parts involved are special components of ultra-thin-wall stainless-steel tubing, used largely in the aircraft industry for compartment ventilation, cabin air conditioning and de-icing ducts. Producing bent sections, *Fig.* 1, is a particularly critical operation. In these components, a combination of thin-wall rigid tube and convoluted flexible sections is required, *Fig.* 2. The latter are employed to compensate for thermal movements and vibration, and to give ease of installation. The majority of these stainless steel components range in tube diameters from 1 to 6 inches. Wall thicknesses range from 0.010 to 0.120 inch.

Tubing is fabricated from strip stock and, previous to the change in manufacturing procedure, all

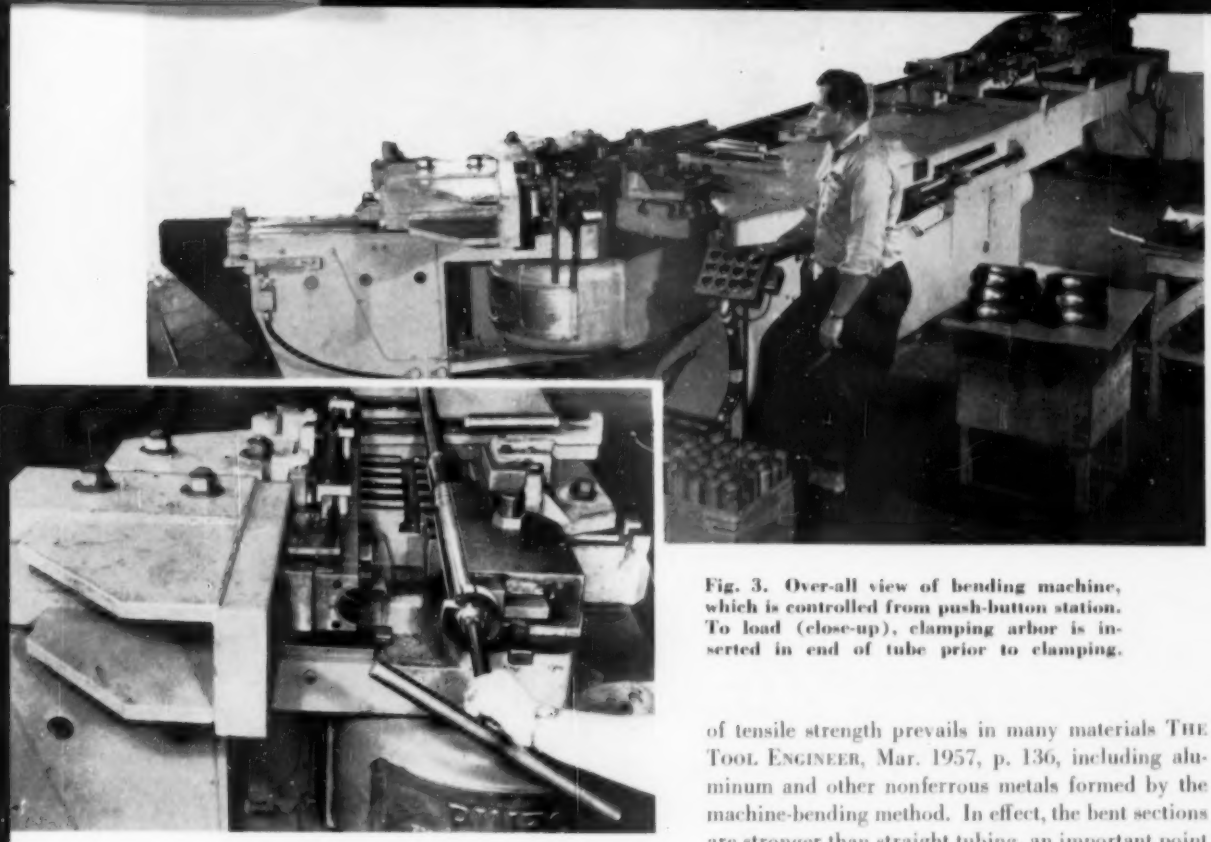


Fig. 3. Over-all view of bending machine, which is controlled from push-button station. To load (close-up), clamping arbor is inserted in end of tube prior to clamping.

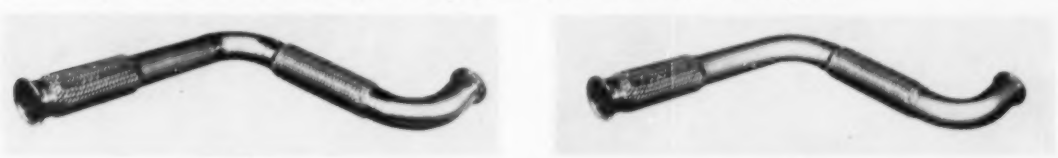
radial sections were formed by conventional half-shell stamping methods. The half-shell elbows were then welded together and, in turn, welded to straight sections, *Fig.* 2. Radii are established by aircraft manufacturers to conform to space requirements as determined by the envelopes for engines and air frames. Most elbows have small radii elbows and frequently two or more are specified for one component.

The major step in revamping manufacturing procedures was the application of cold bending in place of the half-shell stamping method. The new process was adopted after considerable study and investigation showed that thinning of tube wall during the bending operation actually produced a part of higher tensile strength through work hardening. For example, a reduction from 0.025 to 0.020 inch in the outside wall of a typical stainless-steel part of 4 inches OD increased the yield strength of the tube from 66,600 to 110,000 psi. A comparable increase of tensile strength prevails in many materials THE TOOL ENGINEER, Mar. 1957, p. 136, including aluminum and other nonferrous metals formed by the machine-bending method. In effect, the bent sections are stronger than straight tubing, an important point in the application of ducting to jet aircraft or related uses.

To implement the program, early in 1956 the division installed a Pines precision aircraft bending machine equipped with a power-operated mandrel. This is designed to force close-fitting mandrels into the tube workpiece, *Fig.* 1. The machine is equipped with a special electric circuit and push-button controls for separate and individual actuation of machine movements, *Fig.* 3.

In comparison with the half-shell stamping method, it is interesting to note the results secured with cold bending. In the first place, the previous procedure required individual dies for not only each size of tube, but also for each different angle. Tooling costs were correspondingly high. Secondly, by previous methods extensive Heliarc-welding operations were employed in joining the half-shell pieces together as well as in welding them to straight lengths of tube. Finally, there was no successful intermediate inspection that could be devised to avoid rejects

Fig. 2. Typical stainless tubing with flexible sections and 90-deg bends, (top) formed by half-shell stamping and welding. Same unit produced by bending (bottom) is formed with fewer pieces.



Before

After

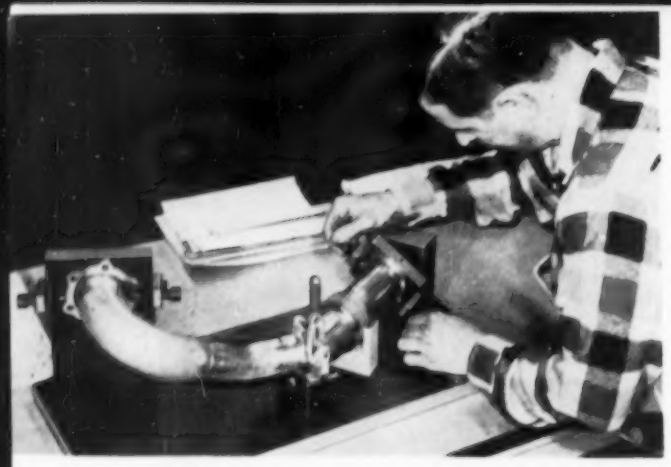


Fig. 4. In inspection of workpiece, inspector checks tolerances at three points or more. Bending machine holds accuracy to ± ½ deg.

of assembled parts. In other words, it was necessary to apply the entire inspection procedure to the finished part.

All of these objectionable factors are now eliminated in most fabricating work. Elbows of uniform cross-section are produced today and there is a substantial increase in the quality of workmanship. Also, greater flexibility is achieved by faster setups. Now, cold formed pieces can be checked for accuracy before final fabricating.

One set of tools takes care of all angle requirements for a given size and wall thickness. With this process it is possible to produce high-quality bends at smaller radii than those accepted as standard in the industry. For instance, bends have been made to radii less than the diameter of the tube. Following are a few of high quality, small radii bends in stainless steel tube that have been made in production:

OD Size (inch)	Wall Thickness (inch)	Center Line Radius (inch)
2	0.035	1¾
2½	0.035	2¼
3	0.035	2¾

Translated to design terms this means that in particularly tight areas angular duct work can be

"Oh, I feed it a mistake occasionally so it doesn't get too cocky!"

Tubing Sizes and Radii Commonly Specified in Aircraft Parts

Tube Diameter (inch)	Wall Thickness (inch)	CL Radius (inch)
	Stainless Steel	
1	0.010	2
1¼	0.010	2½
2	0.012	3¾
2	0.016	4
2½	0.016	5
3	0.018	6
3	0.020	3
3	0.035	3
4	0.017	8
4	0.025	6
5	0.020	10
	Aluminum	
3	0.028	6
3	0.049	3
4	0.035	8
5½	0.035	11

fitted into a smaller space. Furthermore, inspected and accepted bends produced by the cold-bend process have, in every instance, passed final pressure and inspection testing in the completed assembly. Typical final inspection requirements call for the entire assembly to check within ±0.030 on the end dimensions and at one or more intermediate points, *Fig.* 4.

Engineering is, of course, interested in standardizing the radii for given tube sizes as much as possible. A careful examination of jobs in the design stage can effect substantial savings in the number of tools required as well as in greatly reducing lead times. The accompanying table lists thin-wall tube sizes and radii that are becoming more and more standard in the aircraft field. These bends are accurately produced by the cold-forming process.

In making these types of bends the close-fitting multiple-ball mandrel employed has a sizing effect as it is moved under hydraulic power into the tube before clamping. The support provided by the mandrel helps produce smooth, accurate bends. In certain instances where a short clamping dimension is required, a clamping arbor is inserted in the outer end of the tube as a part of the regular tooling setup. A precision pressure die, which is roller-mounted, prevents scraping or marring of the tube as it moves through the bending cycle around the bending form. The pressure die is mounted on a lift-out type master bar for easy changing and is supported by needle bearings.

Much of this work is produced in small lots ranging from as low as 10 pieces to 100 pieces per setup. Thus, real progress has been made in fabricating tube components. The improved quality is one further step by tool engineers to enable air frame and jet-engine manufacturers to build end items of sufficient strength and durability to meet design demands.

CERAMIC JIG speeds induction brazing

By Herbert Schwartz
General Manager
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New York, N. Y.

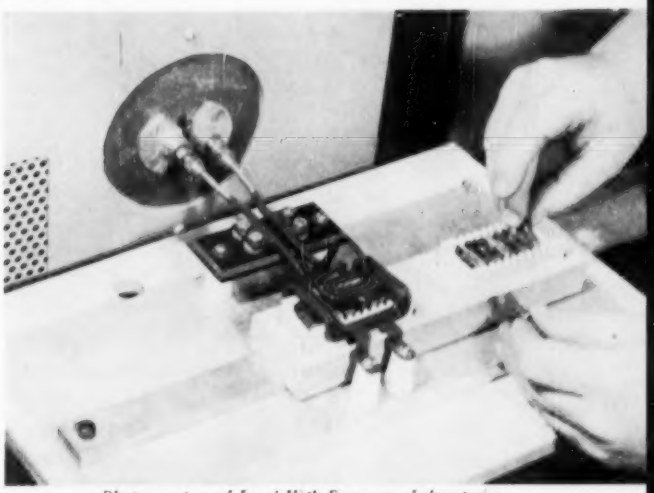

Photo courtesy of Lepel High Frequency Laboratories.

Fig. 1. Setup for induction brazing small copper electrical shunts. Two ceramic jigs are alternated to permit continuous brazing.

FACED WITH RISING labor and material costs, many manufacturers have turned to brazing for joining small parts. Brazing operations can be performed at high rates of speed and the strengths of properly made brazed joints are equivalent to that of the base metals joined.

Torch brazing gives good results when production volumes are low; however, induction brazing is more efficient for high-production work. Often, induction-brazing operations are two or three times faster than torch-brazing operations.

Normally, special jigs are utilized to hold parts in position for induction brazing. The demands on such jigs are severe. The jig material, for instance, must be a nonconductor with high dielectric strength. It must resist flux penetration and "wetting" by molten brazing metals. Additional requirements are resistance to oxidation at temperatures of 1200 F and higher, resistance to warping or dimensional changes during repeated heating and cooling cycles, and resistance to thermal shock. Further, the material should be hard enough to resist wear and abrasion, but should be easy to fabricate into complex shapes.

Only a few materials have this combination of characteristics. Metals are immediately ruled out because they are poor insulators. The thermal insulation and dielectric properties of plastics are better, but plastics will not withstand brazing temperatures. Mineral-based insulating materials react with fluxes and they cannot be fabricated to close tolerances.

Ceramics offer the best combination of characteristics for induction-brazing jigs. A recently developed aluminum-silicate material has given excellent results in production. This material has a dielectric strength of 80 volts per mil in quarter-inch thicknesses. Its thermal expansion of 1.5×10^{-6} ipi/deg Fahr. and compressive strength of 40,000 psi after firing allow it to withstand severe thermal shock. Oxidation at high temperatures is not a problem and dimensional stability is good. Since the ceramic is vitreous, it has little tendency to react with fluxes.

Before firing, the ceramic can readily be machined with conventional tools. After firing, it can be ground or ultrasonically machined to tolerances of $\pm$ 0.0001 inch. Wear resistance is comparable to

that of hardened steel.

Use of ceramic jigs has enabled a manufacturer of electrical equipment to change from torch brazing, to induction brazing, *Fig.* 1. The parts brazed are small copper shunts, *Fig.* 2. These parts are considered difficult to braze because of the high thermal conductivity of the copper, which tends to dissipate brazing heat. A silver brazing metal is used.

The production setup consists of two jigs, which are alternately loaded, positioned under the coils of an induction heater and unloaded. As the parts in one jig are being brazed, the operator unloads and loads the other jig; thus it is possible to braze parts on a continuous basis. Production is 950 pieces per hour, as compared to 300 pieces per hour when torch brazing methods were used for the same part.

The ceramic jig is given much of the credit for this high production rate. Owing to the high dielectric strength of the ceramic, the induction field is concentrated in the workpiece. Similarly, the good thermal insulation properties of the ceramic tend to concentrate heat in the workpiece and brazing temperatures are reached in only 32 seconds. Because the jig material is not wet by the overflow of the brazing metal, there have been no instances of workpieces becoming brazed to the jig.

The low coefficient of expansion of the ceramic was used to advantage in designing the jig, *Fig.* 3. The copper shunts, securely held in the jig, expand at a faster rate than the ceramic. This closes the gap in the brazed joint to correct distance (0.001-0.005 inch) for brazing at 1200 F, the flow point of the brazing alloy.

The satisfactory results obtained from initial production trials indicate that ceramic jigs should be considered whenever induction heating is used for high-production brazing. The dimensional stability and other desirable characteristics of ceramics also make them excellent materials for furnace brazing jigs and similar applications.

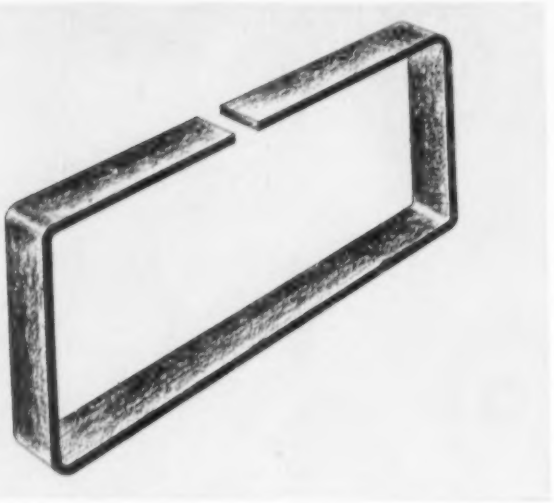

Fig. 2. Copper shunt that is induction brazed at high rates of speed in ceramic jig.

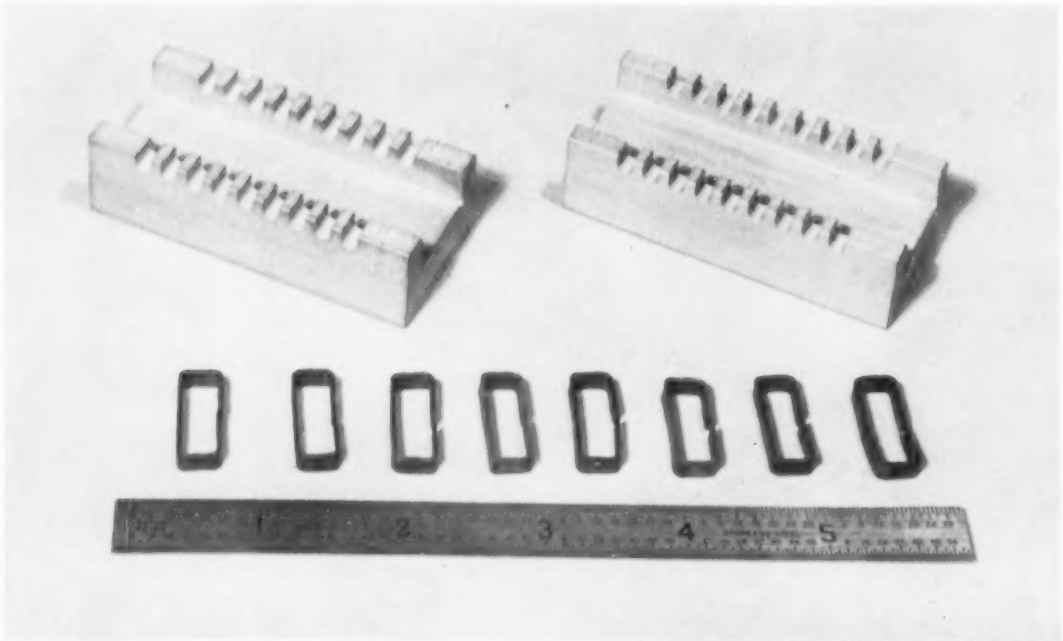

Photo courtesy of Lepel High Frequency Laboratories

Fig. 3. Ceramic jigs are easily machined prior to firing at 2000 F; after firing they have high hardness.

Tool Steel Selection

By The Tool Steel Subcommittee,
ASTE National Standards Committee

THIS REFERENCE SHEET is intended as a guide to the selection of the proper grade of tool steel for approximately 400 common applications.

Five factors were considered in choosing the steels listed for each application: suitability for average operating conditions, ease of machining and heat treating, availability, and cost. In evaluating these factors, it was assumed that the tools made from a given steel would be produced in small quantities for internal use and that commercial heat-treating facilities and machining services would be utilized. It was also assumed that production runs would be neither especially long nor especially short.

Additional information on the steels listed can be found in the *AISI Tool Steel Manual*, the *SAE Handbook* and the ASTE *Tool Engineers Handbook* and *Die Design Handbook*.

Recommended Steels for Tools and Dies

Application	AISI - SAE Tool Steel Recommended	Optional
Arbors	L6	L2
Artisan small tools	W1	W2
Axle burnishing tools	M2	M3
Backing-out punches		
Hand	W1	S2
Pneumatic	S1	S5
Beading rolls	A2	O1
Beading tools	S1	S5
Bits		
Coal mining	S2	W1
Tool	M2	T5
Well	W2	W1
Bolt clipper jaws	S2	S5
Boring bars	L2	M2
Box nut tools	H21	H26
Brick mold liners	A7	D4
Briquetting tools		
Holder	L2	H11
Die (mold)	A7	D2
Ram tip	A7	D2
Ram	L2	A2
Brake dies	L1	L2
Bull points	S1	S2
Bunters	W2	W1
Burnishing tools	M2	M3
Button sets	S1	S2

Application	AISI - SAE Tool Steel Recommended	Optional
Burrs	M2	W1
Cams	O6	D2
Cam rollers	L1	A2
Caulking tools (pneumatic)	S2	W1
Center punches	S2	S1
Centerless grinder rests	A7	D7
Ceramic dies	A7	D2
Chasers		
Hand	W2	W1
Machine	M2	M1
Cheeking tools	M3	M4
Chisels		
Hand	W1	W2
Pneumatic	S5	S1
Die sinking	W1	M2
Engraving	W1	W2
Hot working	S1	S2
Stone	W2	S5
Chuck jaws	L6	L2
Clay pulverizing blades	A7	D2
Cloth cutting knives	M2	M3
Clutch dogs	L2	S2
Clutch pins	L2	S2
Coining dies	A2	D2
Collets-Spring	L2	L6

REFERENCE SHEET

Application	AISI - SAE Tool Steel Recommended	Optional
Collet inserts	M2	D2
Concrete busters	S1	S2
Corrugating tools	M2	M3
Cutting tools		
Asphalt	M3	M2
Auger bits	W1	W2
Axle turning	M2	M3
Boring		
Inserted-bit	M2	T5
Solid-forged	M2	M3
Broaches	M2	M3
Burrs	M2	W1
Cheeking	M3	M4
Counterbores	M2	M3
Countersinks	M2	M3
Cutoff	M3	M36
Drills	M2	M3
End mills	M2	M3
Form tools		
Circular	M2	M3
Dovetail	M2	M3
Gear cutters	M2	M3
Gear shavers	M2	M3
Hobs (gear cutting)	M2	M3
Inserted blades	M2	M3
Keyway tools	M2	M3
Lathe tools		
General-purpose	M2	M3
Fine-finishing	M3	M4
Heavy abrasive materials	T5	M36
Metal-slitting	M2	M1
Metal-slotting	M2	M1
Milling	M2	M3
Nail cutters	M2	M3
Paper	M2	D2
Pipe	S5	S1
Planer tools		
General-purpose	M2	M3
Heavy-duty	T5	M36
Reamers	M2	M3
Roll turning		
Roughing	M2	M3
Finishing	M3	M4
Saw teeth inserts	M2	M3
Screw slotting	M2	M1
Shaper	M2	M3
Taps	M2	M1
Thread-milling cutters	M2	M1
Trepanning	M2	M3
Glass cutters	M2	W1
Dies and die parts		
Bending	D2	A2
Blanking		
Cold	A2	D2
Hot	H26	H12
Bottle-necking	T1	M2
Bulldozer	S1	S2

Application	AISI - SAE Tool Steel Recommended	Optional
Burnishing	F2	W2
Button dies	A2	O1
Can	D4	D2
Cartridge	D2	F2
Ceramic dies	A7	D2
Coining dies	A2	D2
Cold heading		
Dies (open)	W1	W2
Dies (solid)	W1	W2
Heading punches	W1	M2
Indent punches	M1	M2
Header-die inserts	M2	D2
Die insert holders	H11	L6
Cutoff blades	M2	A2
Quills	A2	W1
Knockout pins	S2	W2
Feed rolls	D2	A2
Chamfering cutters	M2	M3
Head-trimming dies (bolts)	M2	M1
Blanking dies (nuts)	M2	M1
Blanking punch (nuts)	M2	M1
Cupping (solid)	W1	W2
Cupping (punch)	W1	W2
Deep drawing (brass)	D2	O6
Deep drawing (steel)	D2	O6
Die casting tools		
Aluminum and magnesium alloys		
Core	H11	H21
Cylinder sleeve	H13*	H11*
Die	H13	H11
Die insert	H13	H11
Die insert holder	H13	P20
Injector nozzle	H13*	H11*
Ejector pin	H11*	M2
Plunger	H13*	H26*
Copper-base alloys		
Core	H22	H23
Cylinder sleeve	H22*	H21*
Die	H22	H23
Die insert	H22	H23
Die insert holder	H13	H11
Injector nozzle	H26*	H24*
Ejector pin	H26*	M2
Plunger	H26*	H22*
Zinc, tin and lead alloys		
Core	H13	H11
Cylinder sleeve	H13*	H11*
Die	H13	P20
Die insert	H13	H11
Die insert holder	P20	L2
Injector nozzle	H13*	H11*
Ejector pin	H11*	M2
Plunger	H13*	A2
Draw die holder	L2	L6
Embossing dies	D2	A2
Engraving dies	W1	O1
Extrusion-cold	A2	O1
Forging dies	H12	H21
Glass-forming	M2	H26
Jeweler and mint	W1	L6
Lamination	D4	M3
Nail	M2	W1
Paper	D4	D2
Powder metal	A7	D2

*Sometimes nitrided for improved wear resistance.

Application	AISI - SAE Tool Steel Recommended	Optional
Plastic mold dies		
Hobbed	P2	P3
Machined	P20	H11
Pipe-threading		
Hand	W2	W1
Machine	M2	M1
Press brake	L1	L2
Roller-cold forming (strip)	A2	O6
Stamping	A2	D2
Striking	W1	W2
Swaging		
Cold	A2	S1
Hot	H12	H21
Thread Rolling		
Flat	D2	A2
Circular	M1	A2
Trimmer		
Cold	W1	A2
Hot	S1	A2
Trip hammer	S1	L6
Tube drawing dies		
Cold	D4	W1
Hot	H11	H21
Tube die holder		
Cold	L2	H11
Hot	H11	L2
Tube die mandrel		
Cold	D4	W1
Hot	H11	H13
Wire drawing dies		
Solid	D4	F2
Inserted	D4	A7
Dollies	S1	S2
Drift pins	W1	S2
Drill bushings	D2	O6
Extrusion tools (hot)		
Aluminum and magnesium alloys		
Backer block	H13	H12
Die	H13	H12
Die holder	H13	H12
Dummy block	H13	H12
Liner	H13	H12
Mandrel	H13	H12
Ram	H13	H12
Shear	H13	H12
Copper-base alloys		
Backer block	H22	H21
Die	H22	H26
Die holder	H22	H21
Dummy block	H22	H21
Liner	H21	H12
Mandrel	H12	H11
Ram	H12	H11
Shear	H21	H12
Steel		
Backer block	H12	H11
Die	H21	H22
Die holder	H12	H11
Dummy block	H21	H22
Liner	H12	H11
Mandrel	H11	H13
Ram	H12	H13
Shear	H21	H12
Files	W1	W4
Forging tools (hot)		
Crowners	H21	H12
Cutoff	H26	H24
Dies		
Gripper	H12	H21
Header	H12	H11
Insert	H22	H21
Piercers	H26	H22
Gages		
Flat	W1	O6
Plug	W1	O6
Snap	W1	O6
Ring (plain cylindrical)	W1	O6
Thread		
Plug	M2	O6
Ring	O6	O1
Gun drills	M2	M3
Guides	D4	A7
Hobs for sinking impressions		
Cold	D2	O1
Hot	M2	H21
Hot sets	S1	H11
Jig bushings	D2	O6
Knives		
Cloth	M2	A2
Leather	M2	A2
Skiving	W1	W2
Paper	D2	A2
Shears, hot		
Circular slitter-trimmer	S1	H12
Sheet	S1	H12
Plate	S1	H12
Scrap	S1	H12
Billet	S1	H12
Bar	S1	H12
Flying	S1	H12
Shears, cold		
Circular slitter-trimmer	D2	M3
Sheet	D2	A2
Plate	S1	S5
Scrap	S1	S5
Billet	S1	S5
Bar	S1	S5
Flying	D2	D4
Woodworking		
Chipper	D2	A2
Draw	W1	W2
Jointer	M2	A2
Planer	M2	A2
Router	M2	M1
Hog	L6	W1
Roofing	M2	D2
Veneer	L5	W1

Application	AISI - SAE Tool Steel Recommended	Optional
Knurling tools	D2	M2
Lamination dies	D4	D2
Lathe and grinder centers	M2	A2
Liners		
Brick mold		
Side	A7	D4
Top and bottom	A7	D4
Sand slinger	A7	D4
Shot blast	A7	D4
Mandrels		
Cold extrusion	D2	A2
Hot extrusion	H13	H11
Nail machine tools		
Gripper dies	M2	W1
Header dies	D2	W1
Pointer dies	M2	D2
Nut-making tools		
Flat stock (cold)		
Blanking dies	M2	D2
Blanking punch	M2	D2
Piercing punch	M2	D2
Cupping die (solid)	S1	O1
Cupping punch	S1	O1
Round stock		
Shear		
Cold	M2	D2
Hot	H26	H21
Upset die-solid		
Cold	W1	W2
Hot	H21	H12
Upset die-insert		
Cold	M2	D2
Hot	H21	H12
Upset punch		
Cold	M2	D2
Hot	H12	H11
Piercing punch		
Cold	M2	D2
Hot	M2	D2
Pipe cutters	S1	S5
Pistons-pneumatic hammer	W1	W2
Pneumatic tools		
Dollies	S1	S2
Backing-out punches	S1	S2
Beading	S1	S2
Bull sets	S1	S2
Button sets or snaps	S1	S2
Caulking	S1	S2
Chipping chisels	S1	S2
Concrete breakers	S1	W1
Rivet buster	S1	S2
Rivet sets	S1	S2
Rock or quarrying	W1	W2
Scarfing chisels	S1	S2
Punches		
Center	W1	S2
Coining	A2	W1
Cold working		
Heavy	S1	S2
Light	M2	A2
Hot working	H26	H21
Nibbling	M3	M2
Shaving or broaching	M3	M2
Rolls		
Beading (cold)	A2	O1
Burnishing	D2	M2
Crimping	D2	O1
Crushing	M3	A7
Engraving	W1	O1
Embossing	W1	O1
Expander	A2	O1
Feed		
Cold	L6	L2
Hot	S1	A2
Forming		
Cold	D2	A2
Hot	H12	A2
Guide		
Cold	L6	L2
Hot	S1	A2
Rim	D2	A2
Seaming	D2	A2
Swaging machine		
Cold	D2	A2
Hot	A2	H12
Turk's head	D2	A2
Sand slinger	A7	D4
Scrapers	W1	W2
Screwdriver bits	S2	L2
Shanks-tool	L2	W1
Shear blades	See "Knives"	See "Knives"
Slitting rolls	See "Knives"	See "Knives"
Spindles	L2	L6
Spinning tools	M2	D2
Stamping and marking tools		
Cold	W2	M2
Hot	M2	A2
Tack headers	M2	D2
Thread rolling dies	See "Dies"	See "Dies"
Twist drills	M2	M3
Wear plates	A7	O6

Acknowledgment

The National Standards Committee wishes to recognize the fine work done by members of the Tool Steel Subcommittee in preparing this material for publication. Members of the Subcommittee are:

H. G. Johnstin (Chairman), Vanadium-Alloys Steel Co.
E. A. March, Crucible Steel Co. of America
W. E. Bancroft, Niles-Bement-Pond Co.
Fred Welther, General Electric Co.
E. E. Hall, Universal-Cyclops Co.
Bruce E. Wright, General Motors Corp.
Victor Kortesoja, Ford Motor Co.
George M. Hargreaves, A.S.T.E. Staff

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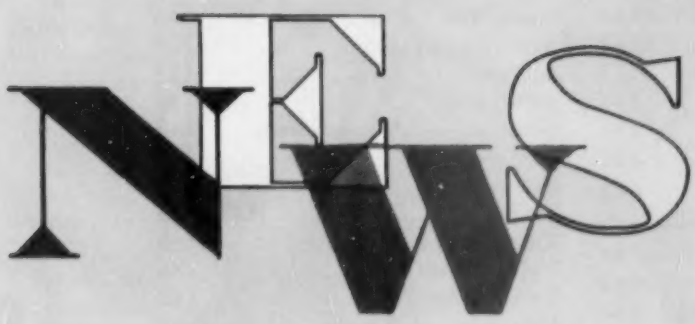

featured this month

chapter news

ALL NATIONAL COMMITTEES MANNED

National committee chairmen and members of their committees for the forthcoming year are named below, completing the listing begun in The Tool Engineer for June.

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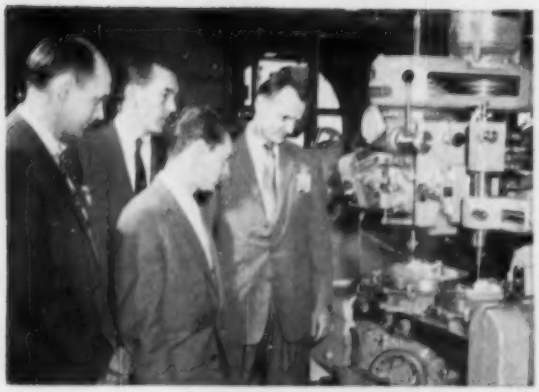


Inspecting a Cincinnati #8-18 duplicator among the orderly banks of machine tools in Purdue's Michael Golden Shops are Kokomo Program Chairman Bruce McPherson, front, and in back, Wilmer Welch and Bill Davis of Winchester, and Frank A. Kocevar of the South Bend chapter.

The R. W. McDowells, left, and Prof. and Mrs. O. D. Lascoe assay the success of the conference after the banquet. These men were conference co-chairmen while their wives planned the ladies' program.

Conference visitors from Geneva, Switzerland, Jean Pfau, physicist, and Charles Fontana, engineer, chat with their compatriot, Jean Barth, now of New Orleans, a consultant on international patents and industrial developments and investments.

Joe Penn, left, a past chairman of the Indiana Council, briefs afternoon panelists Edward Kibbitt of Stupakoff, A. B. Albrecht of Monarch Machine Tool, and Don Power and Leif Fersing of Jones & Lamson Machine Co. "Practical Applications of Oxide Tooling" was the panel's subject.

at Purdue

Welcoming conferees at the opening session are, from left, Prof. H. T. Amrine, head of industrial engineering; Prof. H. L. Solberg, head of mechanical engineering; Cecil E. Chapman, past chairman of the Indiana Coucil of chapters; and keynote speaker, Dr. A. R. Spalding, head of freshman engineering.

tool engineering needs "glamorizing"

Keynoting the day's conference program on the Purdue campus with a thought-provoking address on "Engineering Education Today," Dr. A. R. Spalding stressed the challenge of new frontiers that electronics, rockets and satellites are opening up daily, and impressed his audience with the necessity of glamorizing the more practical and necessary fields such as tool engineering to attract students.

After noting such educational trends as the mathematical approach to engineering problems, rather than the outmoded "cut and try" method, Dr. Spalding, who is head of the freshman engineering department at the university, stated that science is progressing at an "exponential" rate, with ten discoveries growing out of each new idea. Negative findings have proved equally fruitful. He noted that we are now riding the crest of a scientific revolution, more swift-moving and far-reaching than the industrial revolution that preceded it. Engineering education must move to meet its new demands, and keep one step ahead.

Conferees and wives numbering over three hundred dodged April showers to attend the technical sessions and women's activities listed on the agenda of the April 27 conference. Despite the weather, crowded classrooms and well-filled banquet tables attested to the success of the affair, the fifth one of its kind to be held on this particular campus.

Sponsored by the Purdue School of Industrial Engineering in cooperation with the Indiana Council of ASTE chapters, the National Education Committee, and the Purdue Division of Adult Education, the conference was planned and executed under the general chairmanship of Professor Orville D. Lascoe of the industrial engineering department.

Special guests and speakers at the conference included Past President Howard McMillen, toastmaster at the luncheon; Robert E. McKee, former chairman of the National Education Committee, toastmaster at the banquet; and other members of this committee, which met on the preceding day.

Topic of the morning technical session was "Cold-Working of Metals for Production and Profits." Panelists included D. Canute, Yoder Co.; M. A. Willer, Ford Motor Co.; R. J. Wagner, Pittsburgh Screw and Bolt Corp.; and H. C. Weidner of the Townsend Co. James Linn of Kokomo presided.

Wives visiting the campus were treated to an exhibit of metal crafts, a home economics demonstration of "Master-Mix," luncheon with a style show, a dance demonstration by a class in modern dance and, of course, the banquet, at which they joined their husbands for musical entertainment by college talent and a pertinent evaluation of "The College Student and His Problems" by Purdue's Dean of Men, O. D. Roberts.

These quick-thinking New England engineers are storming the brain waves after having spent an active morning touring A. G. Spalding and Bros., Inc.; American Bosch Div., American Bosch-Arma Corp.; Van Norman Machine Tool Co. and Westinghouse Electric and Mfg. Co.

New England Conference Features

high-*speed* photography

brainstorming

Experts at the "High-Speed Photography" session are, from left: Robert Miller, technical representative, Eastman Kodak Co.; Daniel B. Wesson, assistant superintendent, Smith & Wesson, Inc.; and William Hyzer, consulting engineer and physicist of William G. Hyzer and Associates, representing Wollensak Optical Co. A movie, "Magnifying Time," illustrated that high-speed photography as a technique is receiving increasing attention as a "tool" for solving both tooling and production problems which must be studied under actual operating conditions.

C. H. Stonerod, sales engineer, E. F. Houghton & Co., presided over the brainstorming session.

Pace-setting speaker James Low, center, of the National Association of Manufacturers, is shown before launching into his luncheon topic "Are Your Selling Slips Showing?" Beside him are, left, C. E. Schooley, assistant chief engineer, American Telephone & Telegraph Co., who spoke at the dinner on "The Next Decade in Communications," and Kenneth R. Blaisdell, right, chairman of the Central New England Council.

Brainstormer Howard Roat, left, manufacturing manager from A-C Spark Plug Div., General Motors Corp., talks with Robert M. Dickson, program chairman. Mr. Roat led the group in an informative session on brainstorming for new ideas.

Chapter officers representing five chapters of the Central New England Council, are shown from left: Jack Lalor, chairman, Worcester; Herman Wojdylak, vice chairman, Northern Massachusetts; Alvin B. Cook, past chairman, Northern Massachusetts; Paul L. Watelet, past chairman, Little Rhody; John Cieplik, chairman, Southeastern Massachusetts; Thomas B. Walsh, past chairman, Boston; Frank D. Clark, chairman, Boston; and Horace V. Bennett, chairman, Little Rhody.

Industrial Award recipient, Donald C. Power, left, president, General Telephone Corp., is pictured talking with Dean Paul A. McGhee, Div. of General Education, New York University, who received the Educational Leadership Award.

Past Chairman Hartley Barkley, left, is shown discussing the Tool Engineers' Day with Charles O. Herb, editor-in-chief, *Machinery* magazine. Mr. Herb was toastmaster of the evening.

Past chairmen of Greater New York chapter are shown lining up preparatory to entering the banquet room. From left, they are: William Reber, Fred W. Bechtold, Julius Shoen, and Eugene Roth.

NEW YORKERS hold 5th tool engineers' day

With the reading of a proclamation by New York's Mayor Robert F. Wagner, the Fifth Annual Tool Engineers' Day was officially under way May 6. Plant tours were first on the agenda for the all-day meeting, followed by a technical session, social hour and banquet.

Members observed latest processes in building and servicing naval equipment during the Brooklyn Navy Yard tour; new techniques in assembling cars at the Ford Motor Co.; and automatic cigar and cigarette making and wrapping equipment at the American Machine & Foundry.

After returning from the plant tours, members attended a technical session directed by Elmer E. Hallberg, director of engineering, Rockford Machine Tool Co., who presented a film which described duplicating on reciprocating motion machine tools.

Chairman Fred W. Bechtold called the banquet proceedings to order and introduced the toastmaster, Charles O. Herb, editor-in-chief, *Machinery* magazine. Following greetings from national ASTE by Vice President H. Dale Long, Donald C. Power, president of the General Telephone Corp., was awarded a citation for public service; and Dean Paul A. McGhee, Div. of General Education, New York University, the Educational Leadership Award. Mr. Power, featured speaker of the evening, addressed the Society on "Merchandising—Key to the Future."

CONNECTICUT DAY

Three Connecticut chapters of ASTE, Hartford, New Haven and Bridgeport, pooled their efforts to make the Ninth Annual Connecticut Tool Engineers' Day a most successful event. Over 700 members, guests and top executives from this highly industrial area participated in the May 9 program at Hartford.

Four plant tours were scheduled during the morning and early afternoon, including Fafnir Bearing, Gray and Fenn Manufacturing Companies, and Jacobs Chuck. The highly informative technical session following had as its principal speaker, John Campbell, advanced tool engineer of Pratt & Whitney Aircraft. Mr. Campbell, in his talk on "Use of Flow Turning at Pratt & Whitney Aircraft," described a new method of forming stainless and alloy steels which not only saves time, but also a considerable amount of the expensive steels.

Rounding out the day's events was the banquet, at which Speaker Leonard W. Kates, manager of commercial development for Sylvania Corning Nuclear Corporation, told what part nuclear developments will play in industry during the coming years.

Chairman of the Connecticut Day Committee and a member of the National Program Committee, Henry E. Kuryla handled the entire program for the event. At the banquet, he welcomed guests and introduced representatives of the national family, including the president of the Society, Harold E. Collins, who spoke briefly on ASTE activities. Joseph Burns, counsel for the Fuller Brush Company, served as toastmaster for the banquet.

Connecticut's Governor Abraham Ribicoff, right, presents the official proclamation naming May 9 as Connecticut Tool Engineers' Day to Henry E. Kuryla, center, chairman of the event, and A. D. Proctor, Hartford secretary. The proclamation cited the importance of tool engineering to the economic progress of the state.

Leslie S. Fletcher announced at a recent press conference that the ASTE Research Fund Committee has launched its project to establish machinability test standards. Pictured prior to describing their particular responsibilities in the metal-cutting research project are from left: F. W. Boulger, chief of the Division of Ferrous Metallurgy, Battelle Memorial Institute; W. S. Budington, associate librarian, Research Information Service, The John Crerar Library; Leslie S. Fletcher, ASTE research fund director; Richard Gebers, ASTE public relations manager; W. W. Gilbert, manager, machinability development, General Electric Co.; and Hans Ernst, director of research, The Cincinnati Milling Machine Co. The latter two men serve on the Metal-Cutting Steering Committee of the Research Fund.

In the national SPOTLIGHT

Busy Day at National Headquarters was May 25, with two national committees meeting for the first time this year. Here, Public Relations Committee gets a firsthand view of what public relations means—"good Society manners"—as Rudolf Regen from San Fernando Valley presents Chairman George Bennett with a chrome-plated trivet, a token his chapter presents to all guest speakers. Looking on are Ed Kaiser; staff public relations assistants Bill Baird and Gloria McClure; Dick Miller; Sid Jeffreys, center; and Staff Administrator Dick Gebers; Bob Gay; Ed Galvin and Bruce Fairgrieve, to the right.

National Editorial Committee, meeting simultaneously with Public Relations Committee in another part of Headquarters Building, maps the publication policies of *The Tool Engineer* for the coming year. Editor John Greve, right, explains a publishing term to committeemen, seated from left: Harold Hagle, John Hatter, National Director Ben Berlien, Chairman Don Zierk, Harold Sullivan, David Gustafson, and Leo P. Tarasov. The entire editorial staff was also present at this first meeting, each editor explaining his or her part in publication procedures.

Cleveland Group Holds Creative Idea Symposium

Over 150 engineers and engineering students attended the one-day "Creative Ideas for the Tool Engineer" symposium in Cleveland. Presented by the Cleveland chapter, with the cooperation of Case Institute of Technology, the program was aimed at showing the advancements in tool engineering and manufacturing, interesting students in tool engineering, and in interesting local colleges in expanding their tool engineering study programs.

Everett Laitata of Case Tech and Wayne Blackmun of Thompson Products Co., chairman and co-chairman of the chapter's educational committee, and Chapter Chairman Carl Leska arranged the program.

Process planning and machine programming were topics at the morning sessions. Mr. Blackmun and William Salmon, chief process engineer at Accurate Design Service, handled the first subject. A panel composed of S. F. Winchell, Warner & Swasey Co.; J. W. Wilson, The Cincinnati Milling Machine Co.; Karl Scheucher, Thompson Products Co.; Lee Ording, Ford Motor, Aircraft Div.; William Yogus, Valeron Corp.; and Harry Mergler, Case Tech, discussed programming.

Afternoon panel topics and moderators were: machining, Joe Karash of Reliance Electric; forming, Martin George of Columbian Vise; casting, Calvin Metee of Case Tech; and joining, D. C. Fabel, Fenn College. National Vice President William Moreland spoke to conferees on "Tooling for Tomorrow."

SCHENECTADY—Hendrick Hudson chapter met jointly with Schenectady for the officer installation program during the Silver Anniversary celebration. Seated, right, are Schenectady's chairman, W. W. Gilbert; and standing right, secretary, Arnold Hansen. Hendrick Hudson's officers are, seated from left, Gerald Hamme, treasurer; Gerald W. Scheffler, chairman; and standing, Albert J. Jacobsen, secretary; Gennaro D. DeRubertis, second vice chairman; and William G. Edmiston, first vice chairman.

chapter news and views

HAMILTON-DISTRICT—Jack Walton, a chapter member since 1941, and chairman in 1946, receives the first life membership presented by the chapter from Chairman Harry Ward. Looking on from left, are: John Burk, Toronto; and Oreland McIntyre, secretary. —*Russ Wilson*

WINDSOR—High spot in the year's activities was the annual spring ladies night, featuring dinner, dancing, and professional entertainment. Checking one of the gifts to be given are Entertainment Chairman Michael Hollo, Mrs. Hollo, Mrs. W. N. Moore and Mr. Moore, chapter chairman. —*J. H. Kirkwood*

Chapter News and Views

DETROIT—Detroit chapter members are welcomed by officials of The Cincinnati Milling Machine Co., which they visited on a day-long tour. Standing next to the tour train are Emil Vogely, manager of the company's Detroit office; Lenard Lovings, delegate, and Ross Kogel, chairman, both of Detroit chapter; Fredrick V. Geier, company president; Joseph Baldez, machine tool manager; and Edward Novac, chapter chairman. The tour, attended by 316 members, included trips through the foundry and the special products and research divisions, and was highlighted by a dinner and entertainment program hosted by the Cincinnati company.

BENTON HARBOR—Shown from left are: Robert H. Potter, second vice chairman; Earl E. Rock, treasurer; Robert R. Jones, chairman; Paul Broadstone, first vice chairman; and Calvin L. Frappier, secretary. E. W. Dickett, Machine Tool Div. of Sundstrand Machine Tool Co., presented a film on magnet chucking and a talk on "Machine Tools and the Tool Engineer." *—Charles T. Nivens, Jr.*

Donald M. Laflin Describes "Numericord"

"Automation by Numerical Control" was the subject of Donald M. Laflin, Western and Southern District sales manager, Giddings & Lewis Machine Tool Co., when he spoke to several western and one eastern chapter during the month of May. Marlin E. Remley of the same company also gave this talk at San Fernando Valley on May 1. Mr. Laflin's speaking tour included the following chapters: Northwestern Pennsylvania, May 2; Santa Ana, May 7; Long Beach, May 8; Los Angeles, May 9; San Diego, May 14; and Portland, Ore. on May 23.

The "Numericord" system, pioneered by Giddings & Lewis, was explained as the production of intricately contoured, close tolerance workpieces on multi-axis machines, completely controlled through electrical impulses by magnetic tape, on which entire work cycles have been programmed solely from numerical data.

Machining cycles involving as many as five machine axes and 22 auxiliary machine functions can be completely planned and engineered by mathematical computation. Precalculated data, in normal decimal form, are processed by the "electronic brain" computing director into continuous phase-modulated command signals, automatically recorded on magnetic tape. This tape is electronically read in the machine control unit to operate minute-current-response, wide-range amplidyne servomechanisms which perform all feed and traverse functions automatically, repeating the entire machining program for producing identical parts in any quantity, to tolerances limited only by the machine and its servo.

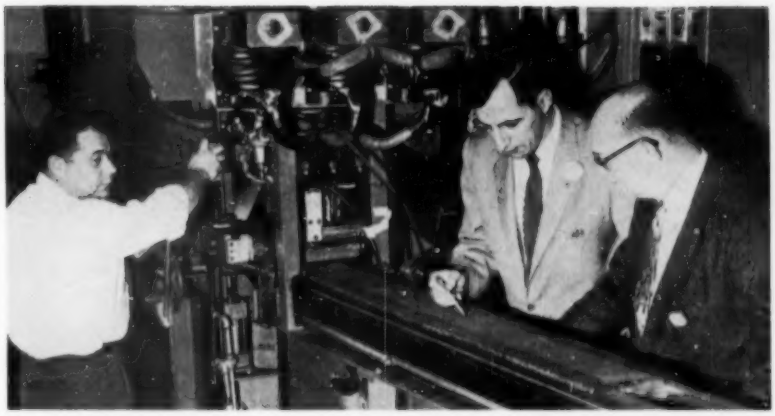
TWIN CITIES—Officers and chairmen pose as they launch into the new year's activities. Seated are: George Minarik, secretary; Jerry Oppel, second vice chairman; Philmore Armstrong, alternate delegate; Norman Sorlie, chairman; Arnold Lidfors, first vice chairman; Arthur Stockwell, treasurer. Committee chairmen standing: Orville Wineland, membership; Frank Liljemark, accommodations; Harland Benson, standards; Alf Eidsvoog, professional engineering; Clifford Gaudette, public relations; Roy Wressell, program; and Michael Ondov, education. Several other chairmen were unable to be present. *—Douglas C. Ostman*

Award Goes to Society Member Donald Wernz

The Glenn L. Martin Co.'s highest award, the "Purple Martin Award," was bestowed upon Donald E. Wernz and Michael E. Wasilisin, both of Manufacturing Research and Development, for their invention of a core-manufacturing machine. Their invention is a machine for making stainless steel honeycomb core material from a large number of corrugated foil sections.

Mr. Wernz has been active for many years in ASTE and has written an article for THE TOOL ENGINEER entitled "Dip Brazing Boosts Output of Aluminum Assemblies."

The machine is semiautomatic in its operation and permits honeycomb core having cells extremely symmetrical in shape and placement to be seam-welded at a rapid rate.



ASTE member Donald Wernz, right, and Michael Wasilisin inspect core manufacturing machine, which they invented, and for which they received the Purple Martin.

Royal McBee Host To Hartford Tour

Over 300 members and guests of Hartford chapter enjoyed a plant tour highlighting finishing methods of the Royal Typewriter Div., Royal McBee Corp. Gilbert F. Berry, Royal's director of industrial relations, gave a brief review of the company's past history, and L. C. Bowen, vice president in charge of production, discussed Royal's future planning. Arrangements for the tour were under the direction of J. Murdock for Royal and Cass Olderman of Hartford chapter. *—C. Morgan Newbury*

SANTA CLARA VALLEY—Alexander Gabay, center, one of 68 charter members of ASTE remaining, receives a plaque recognizing his service to the Society for the past 25 years from Howard Holt, vice chairman. Looking on is National Director Ben Berlien, speaker for the evening. *—Dresden Smith*

WENTWORTH INSTITUTE—Lieutenant Governor Robert Murphy of Massachusetts, center, finds an item of interest in *The Tool Engineer* magazine, part of the student chapter exhibit set up at the recent Wentworth open house. Shown with him are: James B. Metcalf, program chairman; and Charles W. Moody, faculty advisor, at left; H. Russel Beatty, president, Wentworth Institute; and assistant faculty advisor, Roger S. Ames, at right. *—James B. Metcalf*

Tri-Cities Group Tours International Harvester

Tri-Cities members recently toured the facilities of the International Harvester plant at Moline, Ill. The visitors were guided through the machining section where they witnessed many jobs tooled up for high production. They also saw such key departments as raw stores and sheet metal departments, die storage, welding department, toolroom, forge shop and heat-treat department. Members saw the result of good planning in the subassembly departments which feed parts to the main assembly line, and witnessed harvesting machines being assembled from start to finish.

Marv Weyffels, program committeeman, and Mr. Norton, factory supervisor of International Harvester, spoke briefly on the history and progress of manufacturing, after which John P. Murphy, plant manager, congratulated the Tri-Cities chapter for its aggressiveness and activity. *—D. B. Cardinal*

Chapter News and Views

ELMIRA—Francis Shepherd, education committeeman and instructor at Southside High School, left, is pictured with student drawing contest winners: Joseph Rozansky, Elmira Free Academy, first place winner; John Pfiffer, E.F.A., second place; William F. Coons, Athens High School, third; and Thomas Bellow, E.F.A., fourth place winner. *—Edward J. Leszyk*

MERRIMACK VALLEY—John X. Ryneska, left, officiates at the installation of chapter officers: Ralph L. Draper, chairman; Arthur E. Clement, first vice chairman; Leighton L. Reynolds, second vice chairman; and Leon Rice, Jr., secretary. Not shown are Treasurer J. L. Handley, and E. P. Leavitt, delegate. *—Alsdon H. Arold*

Mid-Hudson Meets Jointly with ASQC

The annual joint meeting of the local chapter of ASQC and Mid-Hudson chapter of ASTE brought Leonard F. Freeman before the group as speaker. Manager of quality control for the B. F. Goodrich Tire Co., Mr. Freeman stated that man is a mistake maker, and therefore various procedures are needed to limit the errors. He described various physical and chemical tests that are used to insure a quality product to the customer.

Coffee Speaker Sydney W. Taylor of American Standards Association spoke on "American Standards for Tools and Quality Control," giving a brief resume of the history and growth of the ASA.

Announcement was made by Mid-Hudson's chairman, Harry Keller, that the chapter had contributed prizes to winners at the Poughkeepsie High School Science Fair. A Tool Engineers Handbook went to Melvin Harris, and a slide rule was presented to both William H. Einer and Paul Bickart of Poughkeepsie.

At a later meeting the chapter voted to make $150 available for use in purchasing Tool Engineers Handbooks and subscription to THE TOOL ENGINEER, to be given as prizes to area high school students excelling in science, and to high school libraries. A resume of the chapter-sponsored adult education program at Arlington High School was presented by Walter Niedhardt of the high school. Courses have increased from two given four years ago to twenty available at the present time.

—A. G. V dellly

LONG ISLAND—Retiring Chairman John Hatter, standing left, is presented with a desk pen set by the new chairman, Theodore Borecki, in appreciation for his services to the chapter during his term of office. Seated is the first vice chairman, Jerome Barfus. *—John Miller*

ROCKFORD—Chairman Walter Fraser, center, starts 1957 agenda backed by fellow officers. Seated with him are Ernest Norrman and Marshall Samuelson, first and second vice chairman, respectively. Standing are Larry Geiger, secretary; Leslie Monson, treasurer; and H. Walter Lewis, third vice chairman.

Advances in Automation At Chautauqua-Warren

L. Boese, Cleveland district manager of The Bellows Co., discussed advances in automation, emphasizing the rapid advances during World War II and their effects on pneumatic equipment. Frank Moore and Bob Watkins assisted the speaker.

At the Silver Anniversary meeting H. A. Byron, public relations supervisor, Bell Telephone Co., presented a talk on solar batteries. Mr. Byron had a working model of a solar battery operating two telephones, using its power from an electric light as a source of energy.

Officers installed at the meeting were: Leslie H. Beau Jean, chairman; Laurence R. Green, first vice chairman; Elbert W. Garrison, second vice chairman; Charles D. Seekins, treasurer; Clifford A. Bergquist, secretary; Karl Pierson, assistant secretary-treasurer.

—Walter Carlson

Senior tool engineering students from Utah State University, home of Utah State student chapter, are shown in front of the Arrowsmith Tool & Die Corp., one of ten plants visited during a six-day field trip to the Southern California area. Ross Bowman, chapter chairman, is pictured front row, left, with National Vice President Wayne Ewing, president of the Arrowsmith Tool & Die Corp., far right.

University of Kansas Holds Spring Banquet

Speaker B. J. George addressed the student chapter on "The Human Being, the Tool of Tomorrow" at a banquet attended by several members of Kansas City chapter. Following the talk new officers were sworn in by Harold W. Buddenbohm.

The high membership record was noted and the fact that for the past three years, one of the members has been awarded the scholarship award.

—Joseph M. Haake

INDIANAPOLIS—At Father and Son Night, Sid Collins, sports editor at WIBC, Indianapolis, presented a Chrysler film of the "500-Mile Race." From left, are: Andy Linden, driver; Don Freeland, driver; Jimmy Reese, driver; Larry Whitman, guest; Kenneth Hiatt, program chairman; and Dick Garber, chairman. Handbooks were awarded outstanding students at Purdue University Extension and Lain Drafting School.

—R. E. Morris

PEORIA—Mrs. A. G. Haussler and Mrs. Leo Johnson, far left and right, chat with guest celebrities at the chapter's annual ladies night program. Beulah Schacht, left center, feature writer for the St. Louis Globe-Democrat, was the main speaker, with Mrs. R. C. Lee, Peoria Coronet Lady of 1956-57, acting as toastmistress.

Director Ben Berlien Is Santa Clara Speaker

Guest speaker at Santa Clara's May meeting was National Director Ben Berlien, a partner in the Industrial Steel Treating Co., Oakland. Mr. Berlien gave an informative talk on ASTE activities at the national level, describing what effect they have on local chapters.

He then progressed to the subject of heat treating and practical metallurgy. He cited various problems he has encountered in heat treating steels, and the solutions his firm has found.

Alexander Gabay, a charter member of ASTE, was honored with the presentation of a plaque recognizing his services to the Society during the twenty-five years of its history. Vice Chairman Howard Holt read a short resume of Mr. Gabay's life, noting his achievements in ASTE.

—Dresden Smith

Chapter News and Views

ROCHESTER—Charter member and oldest in the chapter, Charles E. Codd, 84, center, is pictured with Chairman Clifford Sears, left, and Vice Chairman Arthur Lang. *—Carl W. Greenman*

CEDAR RAPIDS—New officers are, from left: James Goodall, first vice chairman; Fred Abel, secretary; Ronald L. Walders, chairman; and Ivan Hand, treasurer.

MILWAUKEE—Official portrait of new chapter officers shows, from left: George L. Riordan, chairman; Harvey Prill, second vice chairman; Ralph Perlewitz, secretary; L. A. Wacker, first vice chairman; and Roger Cox, treasurer.

members on the MOVE

Patrick G. Pecoraro, Tucson, mechanical engineer of Radio Corp. of America, has recently become a registered professional engineer. Mr. Pecoraro was active in Elmira chapter for many years, holding the office of chairman in 1947 and many other offices.

J. T. Welch, Dayton, has been named assistant vice president in charge of coordinating operations of Sheffield Corp.'s national field sales organizations.

George W. Stamm, Pittsburgh, has been elected vice president and general manager of sales at Crucible Steel.

Albert Welsh, chairman of the Constitutional Committee of Sydney, Aus. chapter, has been appointed director of National Machinery Co. He is still available in his capacity as tooling engineering consultant.

W. J. Lohmeyer, Jr., Pittsburgh, has been appointed to the executive sales staff at Jessop Steel Co.

Vern Vocelle, Elkhart-Goshen, recently joined the Detroit office of Pioneer Aluminum Inc. as sales engineer.

Dr. George A. Roberts, Pittsburgh, past president of the American Society for Metals, and vice president of Vanadium-Alloys Steel Co., was elected president and board chairman of the Metal Powder Association.

The Gairing Tool Co. of Detroit has announced three recent appointments: **John N. Miller** to manager, Processing Development and Methods; **Arthur L. Saull** to factory manager; and **Frank J. Goddard** to manager of the Estimating Department.

Two members of St. Louis chapter have had a change of status. **C. A. Brown** is methods engineer, heading the Methods Engineering Div. of the Electronics and Avionics Mfg. of Emerson Electric of St. Louis; **R. I. Johnson** is head processor, same division.

A. F. Sprankle, Akron, has been made technical director and assistant vice president of Vanadium Corp.

Henry Boppel, Dayton, has been named assistant manager of the Autometrology Div. of The Sheffield Corp.

The N. A. Woodworth Co. has elected **George Hohwart,** Detroit, factory manager.

Thomas R. Rudel, Greater New York, has been elected as a director of Gould & Eberhardt, Inc. Mr. Rudel is former president of the American Machine Tool Distributors Association.

Long Island Views High School Problems

A special meeting dealing with "The Problems in High School Education" was held at Long Island chapter, and was headlined by Lawrence L. Jarvie, the executive dean of the State University of New York. Dr. Jarvie's opening remark was that by 1965 the college population would be quadrupled, thus creating two major problems: first, the need for expansion of college facilities; and second, the increasing competition among high school students to find a berth in any college.

He mentioned a possible solution in the two-year community college plan, but warned that the high school student would be forced to choose the subject of his life's work at a much earlier age than is now necessary. This, he said, might lead to many personality problems.

In finding a solution to these problems, Dr. Jarvie stated, the cooperation of every organized unit of our society will be needed. He expressed the opinion that ASTE can and should be a leader in this organized effort.

—John M. Miller

LOS ANGELES—Paul B. Slater, left, a past chairman of the chapter, presents a plaque-mounted engraved silver scroll and a gavel to Francis X. Bale in recognition of his outstanding services as chairman during the 1956-57 term of office. Paul E. Lenk, newly elected chairman, looks on. Mr. Bale, in turn, presented the ASTE President's Award to George Adams, chapter education chairman, for contributing to the chapter's activities in an outstanding manner. *—Gene E. Grahn*

Automation Topics Discussed at Des Moines

Wallace Bryan, industrial engineer, Cross Co., discussed at the May meeting "Automation—Design, Construction and Development." A "gimmick session," organized by Roger Brumble, followed his talk, and included a presentation of the "High Rake Angle Staggered Tooth Milling Cutter."

At Des Moines "Education Night" Erick Rahlson, coffee speaker, explained the "Vego" instrument for measuring various angles for cutting tools.

Joseph Walkup, professor and head of the Industrial Engineering Dept. of Iowa State College, spoke on "Looking Ahead in Engineering Education." He discussed the current problems which engineering schools face. *—John Hug*

MONMOUTH—Shown awarding an honorable mention certificate in *The Tool Engineer* gadgets contest to Monmouth member Chester Pfaff is the chapter chairman, W. W. Halbrook. Mr. Pfaff's gadget was a simple tool designed to produce a complex formed wire in limited quantities on a drill press.

—H. A. Williamson

Ladies Night at Hamilton District

At the twelfth annual ladies night J. A. Sheldon, past chairman, proposed a toast to the ladies with a reply by Mrs. Harry B. Ward, wife of the chapter chairman. Entertainment was provided by a comedy magician and orchestra, and Sam Johnston, chairman of the entertainment committee, was master of ceremonies.

At the March 25 ceremonies, officers of the following chapters were present: Hamilton District—H. B. Ward, chairman; R. G. Fechnay, first vice chairman; R. Vincent, second vice chairman; W. Durrant, third vice chairman; O. McIntyre, secretary; J. Hillier, treasurer. Toronto—Eric Browne, chairman; H. Storey, first vice chairman; W. Smith, second vice chairman; N. Holwell, secretary; L. Allingham, treasurer. Grand River Valley—R. Robertson, chairman; G. Dilly, first vice chairman; P. Bowman, second vice chairman; A. Baird, third vice chairman; J. G. Johnstone, secretary; W. Little, treasurer. Niagara District—W. J. Pentesco, chairman; E. A. Lindwall, first vice chairman; W. C. Snider, second vice chairman; F. W. Bird, secretary; and A. V. Orr, treasurer.

George Churchill, a past chairman of Hamilton District chapter, conducted the installation ceremonies during that part of the closed circuit broadcast. The Silver Anniversary program was held at Fischer's Hotel. *—Russ Wilson*

ATLANTA—New officers pictured from left are: R. L. Wells, first vice chairman; L. C. Volherding, second vice chairman; H. P. Ulrickson, chairman; E. D. Dattler, secretary; and Charles Lowery, treasurer. Featured speaker at the installation was Merril C. Lofton, U. S. regional manager, U. S. Dept. of Commerce. *—L. C. Volherding*

Chapter News and Views

BINGHAMTON—Extending the welcome hand to Speaker Joseph I. Karash, chief engineer, Reliance Electric Co., who made a slide presentation of various plant operations, is Charles King, vice chairman, as John L. Kuharik, public relations, watches. The chapter is rapidly growing with the addition of fifteen members of the Poughkeepsie chapter who have been transferred to this area. *—Joseph Pokorak*

SAGINAW VALLEY—Harry Jeremy, third left, production manager of the Fisher Body—Grand Blanc plant, explains a point of organization to help the visiting tool engineering group fit more effectively into the management-staff team. Listening are, at left: W. H. McGlothlin and James F. Gore; and right: Max Carpenter, Donald F. Early, and Michael Hresko. *—W. H. McGlothlin*

"Crushtrue Story" at Hendrick Hudson

E. M. Hakanson, sales supervisor, Machine Tool Div., The Sheffield Corp., discussed the crushtrue process, a new process for the dressing of grinding wheels, emphasizing its comparison to diamond dressed wheels. He presented a fifteen-minute sound slide film and showed sample parts that had been crush ground successfully.

Presiding at the meeting was Gerald Scheffler, quality control manager, Ford Motor Co. *—Marvin C. Hinkelman*

European Manufacturing Topic at Chicago

President H. E. Collins addressed the Chicago chapter on the subject of "Manufacturing Know-How in Europe." He gave examples of processing and tooling, creative tool engineering geared for small-lot production and discussed how the American tool engineer can profit.

At the Silver Anniversary meeting and ladies night, Countess Maria Pulaski spoke on "My Life as a Spy."

—L. B. Klemme

L. C. Seager Installs Utah Student Officers

Leslie C. Seager, ASTE national director, presided over the installation proceedings for Utah State student chapter, at the recent meeting held jointly with the Salt Lake City chapter. Among the special guests and speakers present were Daryl Chase, president of Utah State University; Professor Frederick Preator, head of the tool engineering department and member of National Education Committee; and Salt Lake City officers Ralph Fugate, chairman, and G. Merrill Shaw, vice chairman. President Chase remarked upon the enthusiasm and cooperation of the student group which brought together 130 people for this occasion, and extended the good wishes of the university for the continued success of ASTE.

New officers for the 1957-58 term are: Carroll Hodges, chairman; Jay Stewart, first vice chairman; Darrell Palmer, second vice chairman; William Eik, secretary; and Paul Siggard, treasurer. At the meeting, Prof. Preator announced recipients of scholarships and awards. This group consisted of William Eik, Darrell Palmer, McKinley Thomas, and Seth Beck. Members of Phi Kappa Phi introduced were Robert Rhodes, Ellis Burnett and Ross Bowman. Mr. Bowman, retiring chairman, received the ASTE Service Award.

Featured speaker of the evening was Professor Alvin Bishop of the civil engineering department, who reported on a recent assignment he had completed on an engineering project in Japan.

Monadnock and Twin States Tour Plant

Fred Harrigan, works manager, Joy Mfg. Co., addressed a joint meeting of Monadnock and Twin States before he conducted the members on a plant tour through the Joy Mfg. Co. Of special interest was the tape-controlled radial drill.

At an earlier meeting of Monadnock, Melvin Knapp, chief metallurgist, Brown & Sharpe Mfg. Co., described the metallurgist's position in relation to the product designer and product fabricator. Mr. Knapp outlined different types of stresses, high and low carbon steels and how they are hardened, and gave a rule of thumb for telling many of the properties of steel when only the hardness is known, showing the importance of correct hardening. Mr. Knapp concluded by mentioning the major advantages and drawbacks of several different hardening processes.

—David A. Piper

Rochester Hears Talk on Carbide Dies

At Rochester recently, Donald E. Oberg, president of the Oberg Mfg. Co., was guest speaker for the second time in two years. In discussing his topic, "Carbide Dies," his enthusiastic presentation has been responsible for two of the chapter's largest meetings.

Using slides showing the many types of carbide dies made by his company, Mr. Oberg asked the audience to present their questions as the slides were shown rather than later. All phases of the subject were covered in the question period, and Mr. Oberg answered each question with five times as much information as requested, demonstrating his vast knowledge of the subject. Some of the questions answered covered clearances for carbide dies as compared to those for tool steel, coolants for grinding carbides, sharpening practices, grades of carbides for dies, coolants now being developed to prolong die life, and stripper design. *—Carl W. Greenman*

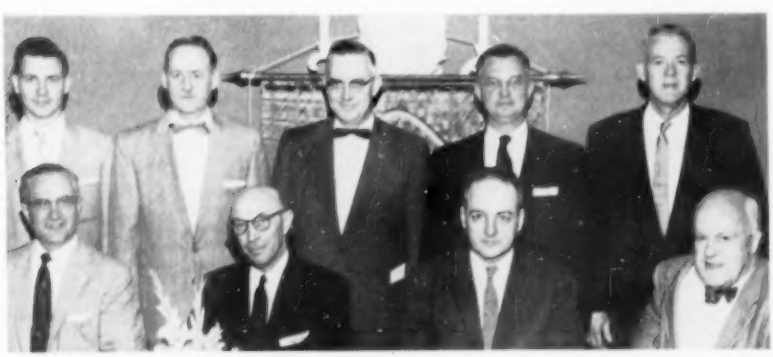
LONG BEACH—Prize winners in a recent mechanical and design drawing contest receive copies of the Tool Engineers Handbook from E. W. Hendry, right, chapter education chairman. Handbook recipients are, from left: Charles Rushing, first prize; William Fuller, second prize; and Richard Conklin, third prize. *—G. E. Rucker*

Aluminum Oxide Topic At Niagara District

Over 150 members of Niagara District heard E. C. Kibbit, Stupakoff Div., Canadian Carborundum Co., present an informative lecture on the subject of oxide cutting tool inserts applied to the cutting of nonferrous metals. Mr. Kibbit traced the discovery of aluminum oxide used to make the cutting insert. Through the use of oxide tools, there is a reduction in labor costs, increased productivity, and good finish quality.

Slides were used to illustrate cutting operations on a given metal and a particular tool application, show how little grinding was needed for finishing oxide cut steel surfaces.

PATERSON—Chapter executives gather around the anniversary cake for a family portrait. From left are: George D'Angelo, second vice chairman; William Aucamp, first vice chairman; Robert Neeb, chairman; George Fleming, delegate; Edward Arrighi, treasurer; and Charles Christakos, secretary. *—J. Jowett*



CINCINNATI—Pictured from left at the 19th annual smorgasbord dinner are, seated from left: Harold McMillen, past president; Max Kronenberg, chapter professional engineering chairman; Speaker Arthur S. Flemming, whose subject was "Defense through Deterrents"; and Judge James Garfield Stewart. Standing are: Frank Kutz, treasurer; Broadus Rusk, second vice chairman; Moler Duff, chairman; Julius Steinhoff, first vice chairman; and Frank Houston, secretary. *—Frank Houston*

Saginaw Valley Tour Attracts Two Hundred

Saginaw Valley members and their friends were guests of Fisher Body, Grand Blanc, for dinner and a plant tour. Two hundred people, with varied interests in the field of tool engineering, were served dinner in the plant cafeteria.

J. B. Kapp, master mechanic, highlighted the new facilities in operation in the plant. On tour, with management acting as guides, the group viewed areas concerned with jig and fixture construction, tool and die making, pressed metal production and weld assembly. Of special interest were new concepts in press design, decoiling, and handling. *—W. H. McGlothlin*

chips and chatter

Norman Gershman, chief estimator, Arwood Precision Casting Corp., pointed out to **Baltimore** how investment castings can, within the tolerances of the process, save money. Mr. Gershman illustrated his talk with slides, films and actual production parts. The film showed the entire process from beginning to end and slides illustrated specific examples of many types of casting.

Boston chapter met at Norumbega Park on "Charter Member Night" and heard Kenneth N. Macomber, chief service engineer, Lapointe Machine Tool Co., discuss electromechanical broaching. Mr. Macomber showed slides and discussed the development of broaching since 1902, noting the tremendous improvements in design and application of machines, fixtures and cutting tools in the past few years.

California State Polytechnic elected the following men for the academic year 57-58: Thayne Wilson, chairman; Fred Tarver, first vice chairman; Leroy Brown, second vice chairman; Samuel Kitaguchi, secretary; and William Worden, treasurer.

Canton's members and guests toured Republic Steel's Massillon, Ohio Div., where they were welcomed by O. A. Bamberger, who gave a talk on his company's production of stainless steel and other products. Over 100 members and guests toured the coke plant, the blast furnaces, steel mill operations, and the stainless steel division.

Cedar Rapids heard Marshall E. Samuelson, first vice chairman, Rockford, sales engineer for Barber Colman Co., speak on "The Hobbing Process." Mr. Samuelson discussed some of the problems in gear making, and presented a movie explaining the details of hobbing and some of the latest advances in this method of producing gears.

SAN DIEGO—T. E. Sweet, left, chapter chairman, presents an honorable mention certificate in *The Tool Engineer* gadgets contest to Carl Stark, whose entry involved a method for machining compound contours.

Quality stamping with automatic presses and combination of dies was the subject H. T. Burke of E. W. Bliss Co. discussed with **Chicago** chapter. Mr. Burke spoke on presses and the combination of various dies for high-production runs.

At **Dayton's** past chairmen's night, Albert B. Albrecht, research metallurgist, Monarch Machine Tool Co., discussed the research being done, its effect on cutting methods, cutting tools, and metals. Past chairmen were honored at the dinner preceding the meeting.

Jack Ritter, plant manager, Whirlpool Corp., Evansville plant one, described its operation to **Evansville** chapter, previous to a tour of the plant.

August Huge, Jr., **Houston,** was voted outstanding member at a recent meeting The evening's discussion included Numericord operations using magnetic tape to store engineering data and operate machine tools. National President H. E. Collins gave a short resume of the Silver Anniversary Meeting.

At **Keystone's** meeting Charles H. Adam, sales engineer, Elox Corp., discussed the history of electrical discharge machining, the difference between tap busters and salvage units and new precision machines; how electrical discharge machining will affect the metallurgist, research, tool and production field; and the comparison between conventional machining and electrical discharge machining.

Lansing members heard Gordon M. Sommers, chief development engineer of the Clearing Machine Corp., Chicago, speak on press design. His talk covered presses of all sizes, and included remarks on new automation concepts incorporated in Clearing transflex presses.

A demonstration of optical tooling was presented to Lansing members at their most recent meeting by H. L. Nicholson, optical tool engineer of Charles Bruning Inc., Chicago. They also heard from Phil Gannon, adviser to the superintendent of Lansing public schools about the city's new junior college, due to open in the fall. A course in tool design will be included in the curriculum.

Frank V. Stauffer, The Bellows Co. Detroit district manager, discussed the fundamentals and general applications of controlled air power before an audience of **Lima** chapter members. His talk exposed the practical problems of achieving automatic control through pneumatic power, and was accompanied by the Bellows film, "Operation Pushbutton."

The Arkansas Gazette's assistant editor and personnel manager, Frank Duff, was coffee speaker at a recent **Little Rock** meeting. His subject was "Personnel Relationship through Communication." The evening's program also included a film depicting the training of an apprentice tool and diemaker throughout an 8000-hour course.

William H. Wohltmann, service engineer for Rem-Cru Titanium, Inc., addressed **Long Beach** members on the subject of titanium applications in the aircraft industry. Robert Bartmess, representing the Tool Research Co., was recently welcomed as an affiliate member of the chapter.

Monmouth learned of "The Story of Measurement" from C. G. Schelly, The DoAll Co. Mr. Schelly discussed the factors responsible for error in the assembling of gage blocks; how to evaluate gage blocks; and the effects of superior surface plate qualities.

Nebraska toured the Omaha World Herald recently. Thomas Oberter, president and manager, introduced Jack Wagner, who explained the printing operation and added that it takes 30 minutes to transfer the latest news to the press in this modern plant.

Chairman George Greaver introduced Ray Dull who gave a short talk on the Milford Vocational School. Eleven students were present.

An illustrated lecture on epoxy resins was presented by George A. DeLorme, president of the Kish-DeLorme Resin Sales, Inc., to members of **Paterson** chapter recently. Die and pattern applications were discussed, and emphasis placed on the potential of plastic tooling in short-run production on parts of intricate shape.

W. B. Corner, manager of Western Sales Division, Rezolin, Inc., spoke at a recent **Phoenix** technical session on the growing importance of plastic tooling in present day manufacturing.

"Chapter Night" at **Portland, Ore.,** featured chapter officials speaking on the past, present and future outlook of the Portland group. Covering these aspects were Chairman Milton Sheely, Prof. Williamson, Walter Brenneke, and

Fred Mondin. It was announced that the chapter's goal of 125 members had been reached.

Reliance Engineering and Mfg. Co. was host to **San Antonio** chapter members who toured the plant. Led by R. Pierce, the group viewed various departments and processes relative to the manufacture of all types of industrial cabinets and related equipment. The tour was followed by the showing of a film illustrating metal-cutting and finishing, presented by Charles Chiodo of Power Tools Rental.

Scholarships amounting to $100 each are to be awarded to each of the three junior colleges in the **Santa Ana Valley** area, due to a recent decision by chapter members there. The money is to be used to assist second-year students in pursuing their education in engineering at the college level. The scholarship checks will be valid only when signed by the registrar of the school where the student is enrolled, thus insuring that the money will be used for education purposes.

Schenectady and **Hendrick Hudson** chapters combined their meetings for the purpose of installing new officers during the Silver Anniversary celebration.

Jan Taeyaertz, president of Precision Diamond Tool Co., lectured at **South Bend** on diamonds, including a discussion of their origin, physical properties, and use in industry. A movie covering the manufacture of diamond tools and wheels accompanied his talk. At the meeting, past chairmen of the chapter were honored. They are E. B. Barber, H. Wentzell, S. Cope, F. Foote, A. Regan, P. Winklemann, N. Smith, C. Stevason and E. Helm. Others include P. Beeler, J. Yoder, L. Haverstock, H. Goltz, J. Kemp, H. Housewerth, J. Berker, and E. J. Nelson.

The processing of bi-metals, including the automatic inspection of bimetal safety switches, was viewed by **Southeastern Massachusetts** members at a recent tour of the Metals and Controls Corp., Attleboro.

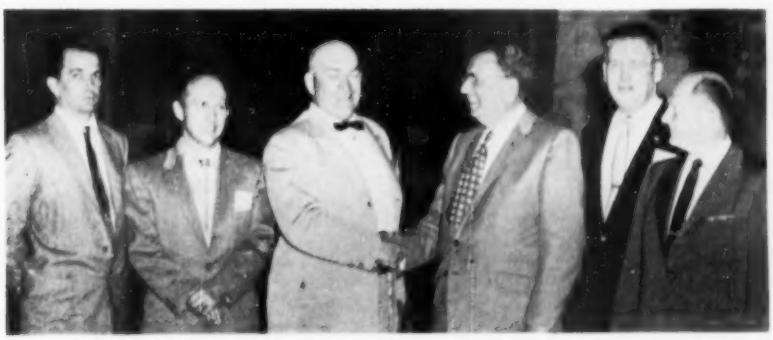
St. Louis chapter had Harlow Klema of the Gorton Machine Co. as a recent technical speaker. His subject, "Tracer Control in Action," covered a wide range of equipment controlled in this manner, from pantograph through electric and hydraulic types of duplication. At an earlier meeting eighty-seven members participated in a tour through the U.S. Defense Corp., subsidiary of Olin Mathieson, ammunition manufacturers. Plant guides, headed by the chief engineer, R. D. Hibbs, escorted the groups through the plant, explaining the various operations.

Kenneth Digney, president of the Syracuse Manufacturer's Association, spoke on the subject of the Silver Anniversary motto, "A Better Life through Creative Manufacturing," before an audience of **Syracuse** members. At the same meeting, A. A. Henninger, industrial consultant and former president of New Process Gear, gave a talk on "Events that Shaped the Syracuse Chapter." Industrial displays were a highlight of this meeting.

Hugh Ecker, sales engineer for Oil Gear Co., Milwaukee, spoke before **Western Reserve** chapter, giving a resume of hydraulics and controls up to the present time. He presented also the latest design in a hydraulic pump which his company has developed.

"Coated Abrasive Belts in the Metalworking Industry" was the film subject presented by Byron L. Brennan and Jim Rice, representatives of Behr-Manning, when they addressed an audience of **Wichita** members recently.

Windsor's May dinner meeting drew 110 members and guests, who heard E. E. Kirkham, project engineer of Pratt & Whitney, speak on "Machine Tool Controls." Emphasis was on numerical control of jig bores.



TUCSON—Returning from the Houston convention by way of Tucson, Executive Secretary Harry E. Conrad, third from right, attends a chapter meeting, to be welcomed by members Harry McClain, James Beach, Chairman Les Detterbeck, John Oberteuffer, and Guest Speaker W. B. Cornner. *—H. K. Hersey*

BOSTON—Kenneth N. Macomber, standing, chief service engineer, Lapointe Machine Tool Co., addressed the chapter on electromechanical broaching. Past Pres. Joseph P. Crosby is seated at left.

Ottawa Valley Discusses Hardness

Hardness and its measurement was the subject Vincent E. Lysaght, divisional sales manager, Wilson Mechanical Instrument Div., American Chain & Cable Co., discussed with Ottawa Valley. During the discussion, Mr. Lysaght recalled the earliest concepts of hardness testing as performed almost 60 years ago by Mr. Brinell. His observations were based upon more than 30 years of experience in dealing with hardness testing techniques.

"Depending on your calling," he stated, "you might very well ask how does hardness testing affect the tool engineers." As an answer, it was pointed out that in today's highly specialized automation age, hardness testing is considered by experts as a must in practically all production operations and as a "tool" or process in the non-destructive testing of metal in all stages of manufacture. *—J. N. Whitefield*

Obituaries

Myron R. Churchill, Saginaw, managing director, Mutual Engineering Service.

Mead J. Flentje, Saginaw Valley, tool designer, Saginaw Steering Gear Co.

Robert A. McAusland, Jr., Springfield, Mass., project engineer, Associated Engineers.

G. Lorenze Miller, Cleveland, patent attorney, Patents, Trademark and Copyrights.

Arthur F. Parker, Sr., Ann Arbor Area, chief tool engineer, Argus Cameras, Inc.

Arthur J. Redmond, Detroit, vice president sales, Richard Bros. Div., Allied Products, Farmington.

Robert I. Sanderson, Calumet Area, foreman, United States Steel Corp.

Arthur E. Stultz, Santa Clara Valley, tool engineer, Hewlett Packard Co.

Chapter News and Views

SAN FERNANDO—Rudolf Regen, left, past chapter chairman, presents the official gavel to newly elected chairman, Robert Broomell. *—R. E. Dittrick*

America and Atoms Topics at San Fernando

"Facets of America's Greatness" was the intriguing title of a lecture presented to members of the San Fernando Valley chapter by Dr. Carl Mason Franklin. On the advisory board to the president of the University of Southern California, Dr. Franklin outlined the country's ability to be a world leader. Our position, he stated, is largely due to our national resources, production capacity, political functions, freedom of speech and the availability of education for all. He also cited the importance of religious freedom.

At the meeting a tape recording of the Houston convention was played. Robert Edgecomb was presented with the ASTE President's Award for his educational efforts, while Al Rando, retiring chairman, received the gift of a clock for his contributions.

At the May meeting, Dr. Marlin E. Remley of Atomics International spoke on the sodium reactor experiment. He expanded on the creative use of the atom, with regard to the design development and construction of nuclear reactors for medical, industrial and scientific application, and for the production of power. The problem of confining the high radiation waste material by burying was discussed, along with a consideration of the possible usefulness of this waste material. *—Robert E. Dittrick*

Heat Treatment Topic at Birmingham

J. S. Pendelton, metallurgist, The Carpenter Steel Co., discussed heat treatment of tool steels. Illustrating his talk with slides, Mr. Pendelton dealt with the hardening of various types of tool steels used in the manufacture of tools and dies for fabrication of steel metal parts. This thought-provoking session was followed by a one-hour-long question and answer period.

At an earlier meeting, Paul F. Hawkins, export sales manager, The Monarch Machine Tool Co., spoke on "Latest Developments in the Turning Field." Mr. Hawkins dealt specifically with the new metal turning lathes produced by his company. Two films were shown, "Dial 62 for Production," which illustrated how the new lathes can double production, and "When the Chips are Down." *—J. E. Wilkinson*

EVANSVILLE—Kenneth B. Fair, sales representative, The Bellows Co., explains some of his company's products to Charles M. Walker, chairman, and James Dawson, program chairman. *—B. Ice*

Tri-Cities Holds Joint Meeting With ASM

Tri-Cities chapters of ASTE and the American Society for Metals were host to Dr. George A. Roberts, vice president of Vanadium Alloy Steel Company of Latrobe, Wisconsin, at a recent joint meeting of the two societies. In attendance were 150 members of the combined groups.

Dr. Roberts presented a comprehensive illustrated lecture on the principles and development of the basic reasons for choosing high alloy steels for high hardness, high wear resistance and high strength requirements. The meeting was then opened to a question and answer period.

Following the technical portion of the program, a film of the Bendix 1956 Air Races was shown. *—D. B. Cardinal*

Kansas City Tours TWA Overhaul Base

Over 175 members and guests viewed the new multimillion-dollar overhaul base recently occupied by Trans World Airlines. This new base is equipped to overhaul the complete engine from dismantling the entire engine and all accessories and components, to cleaning and inspecting. Some parts are manufactured and repaired with the elaborate machine facilities, which include special machines and tools for the overhaul of aircraft engines. A complete test on all engines, which includes five test cells, takes about three hours. A conveyor system covers the entire base from shipping and receiving to all departments and sections and automatically delivers parts and subassembly to the proper departments.

In 1958, TWA plans to move the air frame and sheet metal section into the new overhaul base. Consideration has also been given to the overhaul of jet engines. *—Joseph M. Haake*

LANSING—Ready to take over the chapter reins are these officers: Harvey Robey, second vice chairman; Keith Williams, first vice chairman; Robert J. Adams, treasurer; Lyman W. Mack, chairman; Adrian Smith, emcee for the evening; and Millard King, secretary. *—R. J. Krumrie*

ROCKFORD—Technical Speaker Raymond J. Severson, right, of Ampco Metal, Inc., reviews his talk on bronze and brass alloys with Chapter Chairman Walter Fraser. *—Lawrence E. Geiger*

Mississippi Visits Power Plant Facilities

Mississippi chapter recently participated in a plant tour of the Mississippi Power & Light plant, where the members were guided through the control room, steam generators, condensers and turbine room. Joseph Cavin, public relations coordinator for the company discussed the growing need for electricity within the state due to the influx of industry. An expansion program is now underway, he said, after outlining the company's 38-year history.

—Morris Reed

Positions Available

WANTED—Full-time teacher who can handle class and laboratory instruction in tool engineering courses at the college level. B.S. degree is minimum requirement considered for permanent position. Contact Professor Frederick Preator, Tool Engineering Dept., Utah State University, Logan, Utah.

Position Wanted

ENGINEERING SALES LIAISON AND PROMOTION available to represent industry on commission or retainer basis after July 1, 1957—desire to function through distributors along Atlantic Coast with hard selling on few lines. Write to: Box 101, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Coming Meetings

National

ASTE Semiannual Board of Directors' Meeting, Oct. 31 and Nov. 1, Milwaukee, Wis.

PUBLIC RELATIONS COMMITTEE, July 27, National Headquarters.

ASTE Tool Show and 26th Annual Convention to be held May 1 through 8 at Philadelphia. The Tool Show will be at Philadelphia's Convention Center.

Chapter

EVANSVILLE—July 8, 4:30 p.m., Ruthenberg Field. Annual picnic.

KANSAS CITY—June 19, 7 p.m., University of Kansas Medical Center, Student Building. Harold Ensley, "The Sportsman's Friend," of KCMO Broadcasting Div., Meredith Engineering Co., "Chapter's Sport Night —Hunting and Fishing."

LITTLE ROCK—Boyle Park, annual picnic and outing. Date to be announced.

MACOMB—July 27, 9 a.m., Hillcrest Country Club, 40640 Moravian Dr., Mt. Clemens. Golf party and dinner. Reservations through Don Everhart, program chairman.

MISSISSIPPI—July 13, annual family picnic.

OKLAHOMA CITY—July 2, 6:30 p.m., The Branding Iron. Films, "The Art of Generating & Gear Mfg. Equipment," "Metal Stamping Production" and "Fabulous 500."

SAN FERNANDO VALLEY—July 10. "From Infinitesimal to Infinite" by Dr. Lester Reukema, professor of electrical engineering at University of California.

SANTA ANA VALLEY—July 2, 7 p.m., Palms Restaurant, Anaheim. "High-Temperature Brazing" by Mel James, sales manager, Fabriform Metal Products.

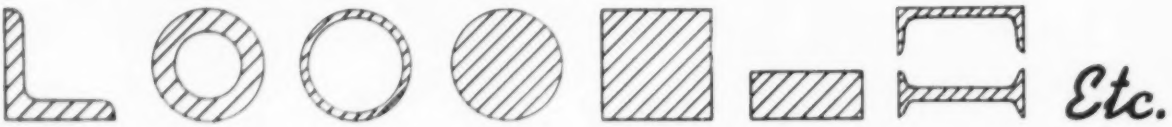
TUCSON—July 9, 6:30 p.m., Sportsman Club. "Tool Steels for Die Casting" by E. E. Lull, staff assistant, Tool Steel Sales Div.

OKLAHOMA CITY—July 2, 6:30 p.m., The Branding Iron. Two films: "The Art of Generating and Gear Manufacturing Equipment" and "Fabulous 500," narrated by Ed Thorgersen.

CANTON—New officers being sworn in by J. Huet are, from left: J. C. Rickey, treasurer; C. H. Roudebush, secretary; R. J. Killian, second vice chairman; J. J. Babbo, first vice chairman; and J. L. Nickas, chairman. John F. Buckman, Jr., president of Canton City Council, spoke on the importance of tool engineers. *—C. Smith*

Does your shop BEND or CUT metal in these forms?

If your shop does either bending or cutting of these forms of metals . . .



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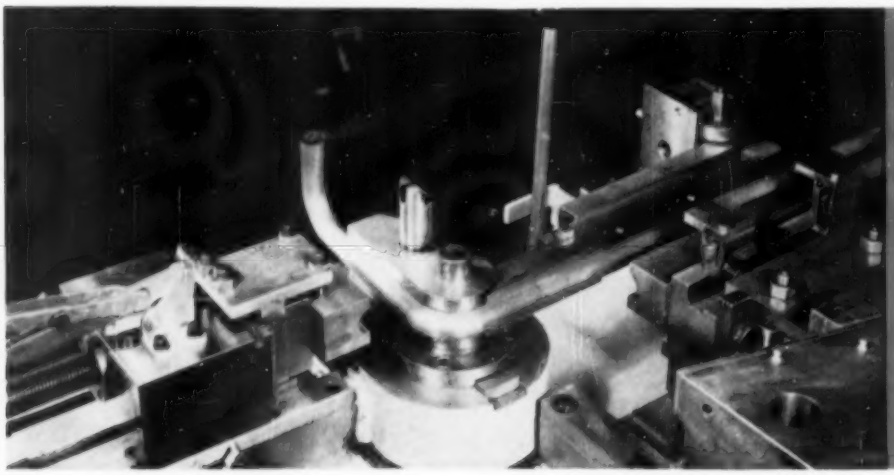

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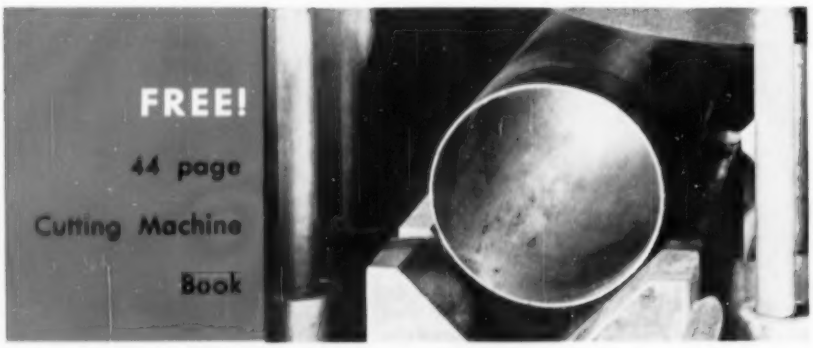

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PROGRESS IN PRODUCTION

UNUSUAL CONVEYOR LAYOUT FACILITATES PRODUCTION FINISHING

A specially engineered finishing system to speed parts washing and drying is solving problems the G. H. Tennant Co. was experiencing in painting production quantities of 1000 different parts for their equipment.

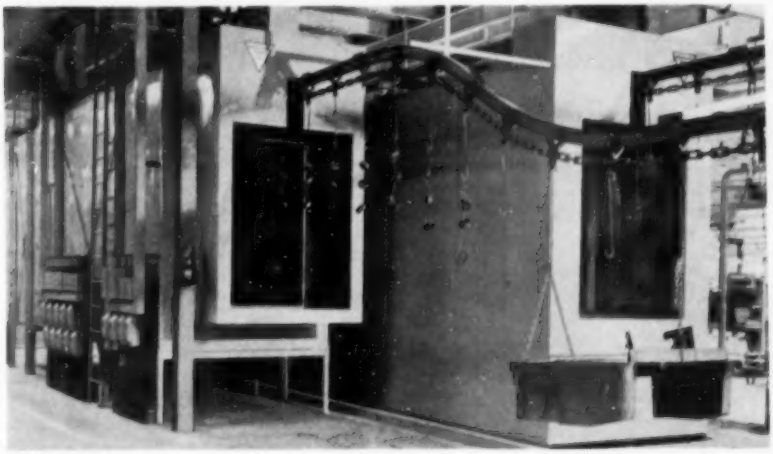
A continuous conveyor system facilitates spraying and baking of both the prime and finish coats, enabling the company to do in 24 man-hours what formerly took 80 man-hours, while assuring a superior finish. The system, including a three-stage washer, dry-off oven, two-man spray booth, and 74-ft baking oven was engineered, built and installed by the Despatch Oven Co. Metal parts, from basketloads of small units to large frames measuring up to $4\frac{1}{2}$ x 5 x 6 ft, enter the 44-ft washer, where an acid pressure spray converts the surface to an iron-phosphate coating.

A cold-water rinse, then a hot rinse harden the phosphate salts. Parts proceed immediately into a dry-off oven which is maintained at a 350 to 400 F temperature. They are then carried to the down draft filter spray booth, where two men apply the prime or finish coats. Conveyor speed is about 8 ft per minute to allow sufficient spraying time for any size part. After the prime coat is sprayed and baked on, parts go through the system again with the washer temporarily shut off for spraying and baking of the finish coat.

The bake oven is installed on the roof of the plant to save floor space. Freshly sprayed parts travel up and into the oven through its underside opening. Baking lasts 8 min. at 330 F in two passes.

The system will handle 100 to 150 loads at one time. A complete cycle for one coat requires 60 min.

All parts enter the three-stage 44-ft washer at right, then return through the 34-ft dry-off oven at left. Master control panel is located beside the dry-off oven.



SCALE REMOVAL TECHNIQUE DROPS FABRICATION COSTS

Savings of an estimated $5000 per month in its fabrication costs involving titanium are being realized by Temco Aircraft because of a new process. Primarily the economy grows out of the reduced number of rejections.

The new patented Ti-Brite technique, developed in Temco's materials and processing laboratories by J. J. Dailey, removes a tough oxide scale from the titanium through electrolysis. There is no damage to the material.

Prior to this development, standard methods that were used to remove scale involved considerable hand labor and expensive installations. In many cases, acid baths removed the scale but left an uneven etch on the metal underneath. When no scale was present, as on edges of newly punched rivet holes, such etching frequently made parts unusable by elongating the holes. It is essential that scale be removed because it lowers corrosion resistance of titanium, makes parts inspection difficult and sometimes hastens metal fatigue.

Experimenting with electrolytic processes, which involve running an electric current through the titanium while it is immersed in an acid solution, led to an effective descaling method that is more

efficient than others in use. As a result, there is no need for expensive heating equipment for the molten salt solutions. One man now handles an operation formerly requiring eight and involving much hand scrubbing of parts between immersions of the material in acid pickle. Most important, the process leaves titanium with a smooth, natural surface. With the process, Temco is now descaling machined parts so delicately that machining marks are still visible on the metal after processing.

PROJECT STUDIES MEANS TO REACH NEW PRECISION

A joint government-industry project, participated in by Pratt & Whitney Co. cooperating closely with the National Bureau of Standards, bids to make possible accurate measurement of thicknesses up to one-tenth of a millionth of an inch. P&W has assigned its gage research director, Albert M. Dexter, Jr., to the project which is being conducted under direction of Dr. Irvine C. Gardner, chief of the Optics and Metrology Div. of the NBS. Interest from Pratt & Whitney's viewpoint stems from belief that many precision requirements of modern machining operations demand a degree of accuracy not presently obtained. Edward J. Shages, company vice-president, pointed out that manufacturers of automobiles, aircraft powerplants and guided missiles were among the major industries that needed such tolerances. "Precision of this calibre will result in longer life, more efficiency, ease of assembly and lower manufacturing costs," he stated.

Although no accurate means of gaging to the fine tolerance now hoped for has yet been devised, both NBS and company officials believe that research so far indicates early success to the project.

According to James B. Wilkie, manager of the company's gage division, Nature's own yardstick of a wave length of light will be the tool whereby the super-precision measurement will be achieved. The project involves determining means to control temperatures to one-hundredth of a degree Fahrenheit. This involves controlling humidity, vibration and barometric pressure. It also involves an accurate means of measuring the "wringing interval" or infinitesimal lengths of space between gage blocks.

CONTINUOUS VACUUM FORMING FOR PLASTICS

Sheet plastic is being vacuum formed by a new continuous method that takes sheet directly from the extruder to the vacuum roll where it is formed to a desired pattern while still warm and

soft. Result is a low-cost continuous sheet. According to Quick Plastics, who announced the process, styrene, polyethylene, acetate and butyrate are being formed by this method, and other materials can also be used.

Present equipment makes sheets 24 in. wide in continuous lengths with thickness varying from 0.008 to 0.080 in. Formed sheets may be any color, black, white, transparent or translucent.

PRODUCE CARBIDE BURRS AUTOMATICALLY

Carbide blanks are automatically ground to size, shape and with the specified number of flutes by this cam actuated burr grinding machine. Wet grinding with a diamond wheel under water coolant permits each flute to be ground from the solid in one pass. This controlled fluting produces uniform cutting edges. According to report,

machining time in many instances has been reduced by more than 75 percent.

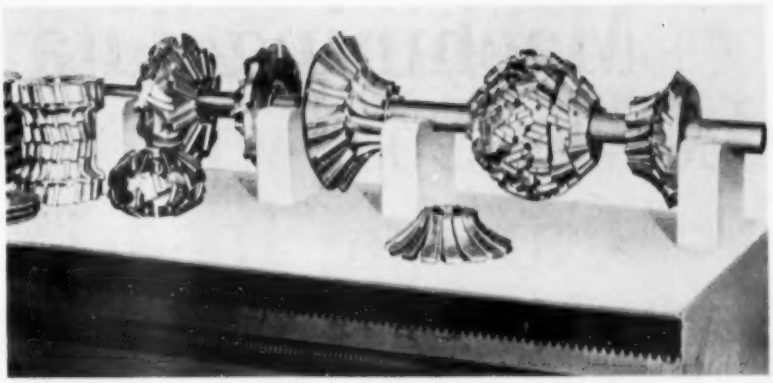
With this equipment, developed by the Atrax Co. after an extensive research program, it is possible to manufacture, on a mass-production basis, precision carbide burrs to close tolerances with good finish, sharp cutting edges and long life.

The grinders were designed, developed and built by Atrax for manufacturing their own line and are not for sale.

WOODEN MODELS SPEED CUTTER DEVELOPMENT

Wooden dummies proved profitable in Goddard & Goddard's design and development of milling cutters. The company's contract involved thousands of dollars worth of special cutters for milling stainless steel turbine blades.

In an effort to obtain the finest possible cutter performance, engineers built dummy models of each cutter to determine the best possible blade arrangement and alignment, best and most economical way to manufacture, and the most economical design to maintain and sharpen.



Largest of the inserted blade type cutters shown has a 15½-in. diameter.

Cutters were made with chip breakers and staggered tooth design to ease load on the machines. They proved so successful that their potential machining capabilities exceeded the capacities of the machines themselves.

Machining Titanium at Lower Cost with Throw-Away Carbide Insert Tooling

V-R Face Mill Cutters Save $169.60 In Machining 1186 Cu. In.

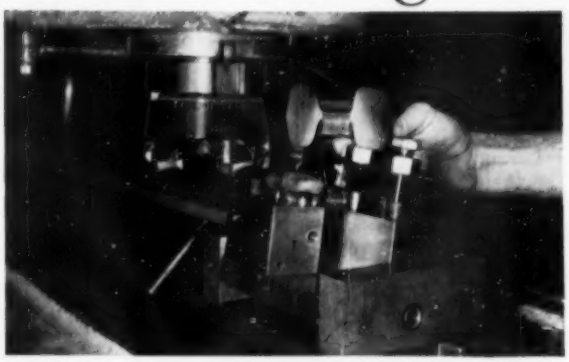
A change from brazed tipped tools to throw-away insert carbide tooling has effected major economies in machining titanium at Convair Division of General Dynamics Corporation (San Diego Plant II). Following is a typical example.

Job: Machining AMS 4925 titanium bar stock on Cincinnati vertical mill. Depth of cut from .08" to .220". Feed .004 IPT. Speed 95 RPM (100 SFM). Total stock removal 1186 cubic inches. V-R grade 2A5 carbide throw-away inserts.

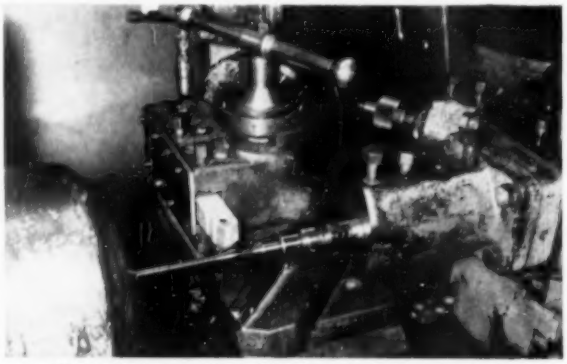
COST COMPARISON

	Old Method	New Method
Tool	Brazed tip cutter	Vascoloy-Ramet 4" dia., 30° lead angle neutral rake cutter with V-R Grade 2A5 ⅜" square carbide throw-away inserts
Stock removal per cutting edge	25 cu. in. per grind	99 cu. in. per corner (4 usable corners)
Carbide cost	$20.00	$33.60
Regrind cost	$94.00	None
Downtime	470 minutes for cutter changes—$94.00	24 minutes for insert changes—$4.80
TOTAL COST Tool repair and downtime	$208.00	$38.40

For complete data on cost-saving V-R throw-away insert style face mill cutters, ask for Bulletin VR-571; for single point toolholder data, Catalog VR-437. Call your local V-R Representative or Distributor, or write:



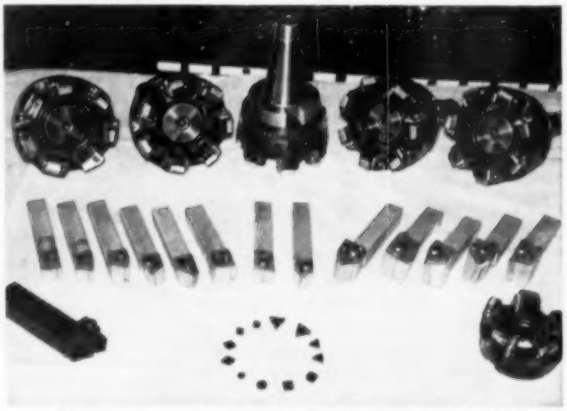
V-R throw-away insert face mill cutter machining titanium at Convair Division.



V-R toolholder and carbide insert turning titanium at Convair Division.

FM-600

Convair-built F-102A supersonic jet interceptor incorporates many titanium parts.



Display of typical Vascoloy-Ramet throw-away insert type tools used at Convair Division.

Cemented Carbides • Tantung Cast Alloys
Toolholders • Carbide Cutting Tools

864 S. Market Street
Waukegan, Illinois

Vascoloy-Ramet Corporation
SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

TOOLS *of today*

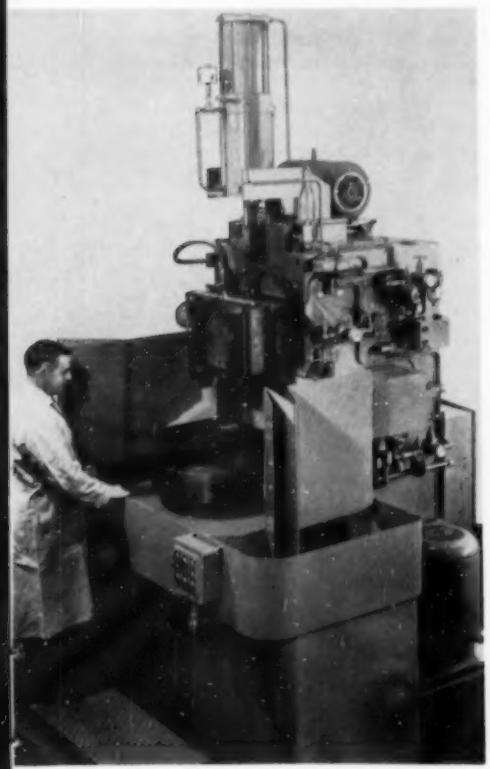
Finishing Machine

Series of single-station finishing machines, designated BL-1, is designed for contour turning, boring and facing; straight boring; surface grinding or honing; ID or OD grinding; contour, horizontal or straight milling. They are suitable for rough and/or precision finishing operations. The machines utilize standardized, cam-actuated heads. Application of interchangeable heads to a single-station machine allows automatic cycles of operation.

The BL-1 series is available in single or double spindle models and with single, multiple or variable spindle speed drives. Motor drives from 3 to 20 hp per spindle are available. Gross slide travel is 5 in.; longitudinal slide travel is 6 in.

Design features include rapid slide traverse during idle time, vertical spindles for easy loading and accurate seating of parts in chuck, wide open, easily accessible tool area, wide chip space, optional lift slides for loading of extra large pieces.

Hoern & Dilts Div., New Britain Machine Co., Saginaw, Mich. **T-7-1**



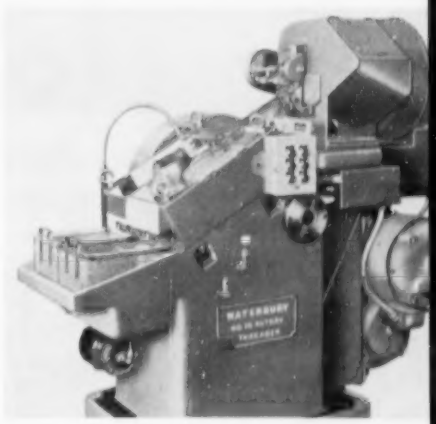
Rotary-Die Threader

Designed for profitable thread-rolling production on long or short runs, this rotary-die threader employs a circular die and die segment. The machine can thread all types of machine screws, as well as other headed parts. It will handle blanks from ¼ to 2 in. long and thread diameters from #6 to ¼ in. Production rates on blanks of conventional screw materials, such as steel, brass and other alloys, range from 200 to 600 per minute. Stainless steel blanks can be threaded at from 60 to 200 per minute.

A safety device in the flywheel protects the dies if an oversize, bent or deformed blank is delivered through the feeding chute.

A separately driven rotor vane feed is used and a four-step pulley arrangement allows the operator to select the feeding speed.

Although normally equipped with a variable speed motor drive to permit varying production speeds, the machine can be supplied with a single-speed motor if desired. A knurling attachment can also be provided as special equipment.



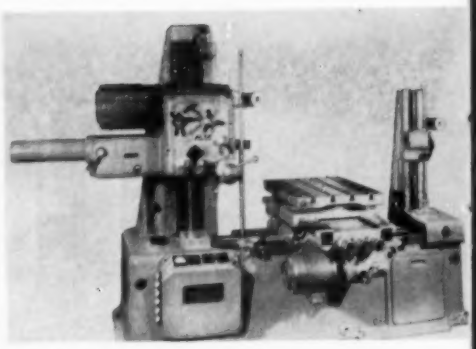
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. **T-7-2**

Multipurpose Machine

The 2-in. Supermill Model AL55 can be used for precision boring, drilling, milling and turning at high production rates. It is equipped with optical reading attachments graduated in 0.0001-inch increments for the travel of the table, spindle and outboard support.

A built-in 28x22-in. rotary table assures rigidity and precision that can be easily measured to 0.0001 in. It is motor-driven, independent of the headstock, with 6 power feeds and rapid traverse in all directions. Capable of rotating 360 deg, the table can be indexed quickly every 90 deg by means of built-in stops.

A disk clutch between motor and gears immediately actuates the 12-speed



spindle, which is stopped by means of an electric brake.

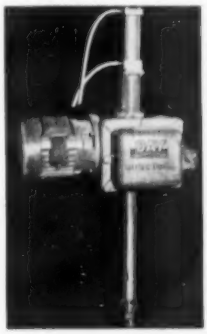
Available with the A1.55 are: 180 and 360-deg- ASME standard vertical heads, facing head, horizontal milling spindle and turning chuck, as well as a full line of boring bars and tooling.

New Equipment Div., S & S Machinery Co., 140—53rd St., Brooklyn 32, N. Y. **T-7-3**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Torquing Unit

Heavy-duty, self-contained units for drilling, boring, tapping, counter-boring, step drilling and other applications requiring high torque incorporates a motor, drive and controls housed in a flange-mounted sealed case. Long stroke, from 6 in. up, permits use on a range of work including deep boring. The package unit, called the Robotorq,



delivers from 35 to 4,000 ft-lb for taper tapping and other heavy-duty operations. Built-in torque limit protects machine and work. A signal warns of dull or broken tools. Reversing mechanism automatically counts revolutions, backs out tap and clears the piece.

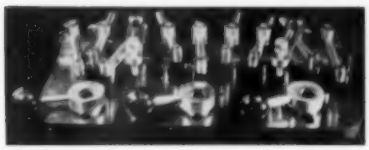
The unit can be mounted in horizontal, angular and vertical positions to fit individual or automatic transfer machines or conveyorized production lines.

The George L. Day Co., 1227-31 Niagara St., Buffalo 13, N. Y. **T-7-4**

Adjustable Drilling Jigs

The Jable adjustable drilling jig system is designed to facilitate drilling holes to close limits in flats, profiled shapes and angles without an individual jig. Bushings are clamped to a template, while holes 3/16 in. diam are drilled. Holes are then opened out to the required size. In this manner, as many as nine holes can be drilled at one setting. Additional holes may then be located by passing the components through the jig with another setting. Holes have been reproduced to ± 0.002 in. in batches of 50 or more, with a template-making time of 15 minutes and jig-setting time of 5 minutes.

Although primarily designed for short runs, rigidly fixed plate attachments



can be incorporated to handle longer runs. Plates are jig-bored and provided with bushings and can be quickly put in use by unskilled labor.

Stock from 3/4 to 2 in. thick can be drilled. Ground bushings are placed between the upper face of the raised portion of the casting and the under face of the drill bushing arms to accommodate the various stock thicknesses. If necessary, longer clamping cylinders can be obtained from stock, as can plate attachments.

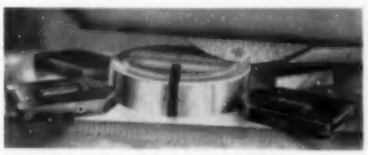
The system can be converted into a light milling or tapping fixture by removing the arms and leaving the two top clamps in suitable positions.

It can be broken down and reset in a matter of minutes after each job.

Douglas Export-Import Corp., 17 Battery Pl., New York 4, N. Y. **T-7-5**

Magnetic Chuck Clamp

This work-holding device is designed to hold nonmagnetic materials on a magnetic chuck. By utilizing the on-center



lever principle for moving and locking the clamping plunger, the magnetic chuck clamp holds both rough, irregular castings and finished parts securely without danger of distortion or loosening of the workpiece due to tool or grinding wheel pressure. A round shaft or sphere can be held directly on a magnetic chuck without V-blocks or other clampings.

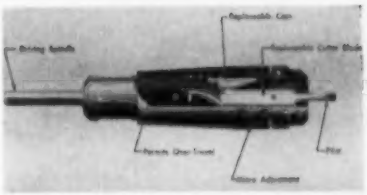
A set consists of two clamping devices and two solid backup blocks of the same general dimensions. Two standard sizes are available; the small model is 1 15/32 x 2 1/4 x 3 1/4 in. with a 3/8-in. diam hardened steel serrated face plunger for clamping; the large model is 3 31/32 x 3 1/4 x 4 1/4 in. (without accessories) with a clamping plunger of 5/8-in. diam hardened steel. A tapped hole in the end of this larger size is for holding clamping attachments. Additional sizes can be made for specific requirements.

Lemco, Inc., R. D. #2, Cogan Station, Pa. **T-7-6**

Countersink Tool

The BakSink tool offers a rapid and direct access for cutting angles and radii on reverse surfaces. It can also be used in some back-forming and grooving operations.

Designed to offer accuracy within close tolerances, the tool is adaptable for production use as it requires no specialized equipment, spindle or workhead, and cuts on forward feed only. No



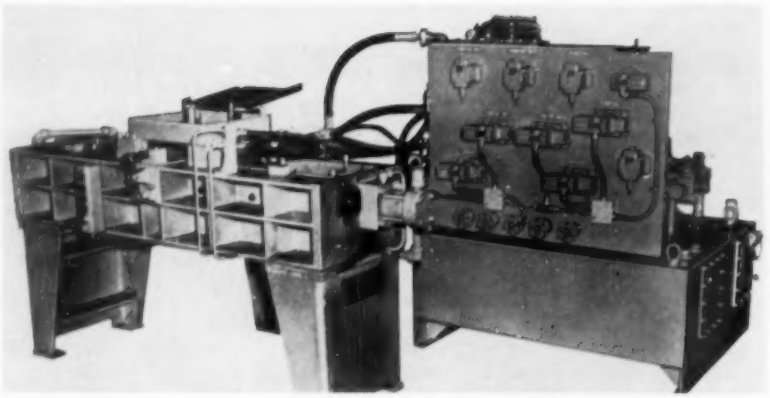
tools are required for adjustments or for disassembly. Interchangeable cutters and pilots allow for a range of forms and hole sizes within reasonable limits.

Cogsdill Tool Products, Inc., 12980 W. 8-Mile Rd., Oak Park 37, Mich. **T-7-7**

Tube Forming Machine

Hydraulically operated Series 700 automatic double end tube forming machine has a smooth motion to form high-quality tube end shapes at production rates up to 1500 pieces per hour. The tube is transferred from a gravity magazine to the work position, clamped, formed and ejected automatically.

Through the use of double stroking work slides with indexing of the forming tools between each stroke, the ma-



chine can be arranged for double operation work.

It can be tooled to expand or reduce in diameter, bead, flare or flange the ends of tubing in various sizes and lengths. Combinations of these shapes may be obtained through the use of the double stroking feature.

The Vaill Engineering Co., 137 E. Main St., Waterbury, Conn. **T-7-8**

Interlocking Cutters

Interlocking staggered-tooth side milling cutters are designed with teeth so positioned that the trailing edge of the leading section is always slightly ahead of the leading edge of the trailing section. Consequently, there is no obstruction to free flow of chips across the cutting face; sharpening requirements for

the cutter are minimized; and cutting temperatures remain low.

Also, because of the absence of chip accumulation, depth of cut may be as great as depth of cutter hub without impairing cutting efficiency.

Interlocking feature of the design permits use of shims to keep the cutter accurate at its normal cutting width throughout its life. Varying the thickness of the shims makes it possible to use the same cutter for several widths of slots.

Cutters of this type are useful for long deep slotting cuts in steel, shoulder cuts and for milling operations where depth of cut exceeds the width of cutting face. They may be used either in steel or soft nonferrous materials.

Barber-Colman Co., Rockford, Ill. **T-7-9**

Forming and Cutting-Off Machine

Forming and cutting-off machines, designated No. 00, are available in either a simplified or standard model. There is no vertical slide on the simplified model. A stop holder and slide capable of carrying one tool is substituted for the turret and turret slide to provide longitudinal movement. Basically, the machine is designed for straight forming and cutoff work. A turret tool can be mounted on the tool slide for any necessary turret operations, using the swing stop for location of piece lengths.

A second, less simplified machine (illustrated) has a conventional six-hole turret and turret slide to provide maximum versatility for normal screw machine operations other than those requiring reversal.

Both machines are arranged with full chain-driven spindles capable of maximum speed of 10,000 rpm. Eighteen speeds range from a maximum of 10,000 to a minimum of 630 rpm, and either

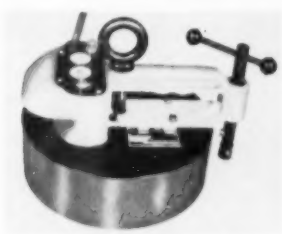
carbide or high-speed steel tooling is feasible.

Each type of machine has bar capacity up to ½ in. in diameter with no limitations as to type or shape of material, providing that the distance across the corners of squared or hex stock is not more than ½ in. Either machine has maximum turning length to 1 in. with drive shaft rotating at 240 rpm or 1½-in. max turning length with the drive shaft running at 120 rpm.

Brown & Sharpe Mfg. Co., Providence, R. I. **T-7-10**

Magnetic Plate Clamp

Model PH Mag-Tool magnetic plate clamp is designed for holding heavy metal plates in alignment for welding without auxiliary equipment. The



clamp exerts up to 8,500 lb of magnetic power.

The tool weighs 85 lb, and operates on 65 watts power.

Magnetic Tool Corp., 1955 Lafayette St., Santa Clara, Calif. **T-7-11**

Plaster Release Agent

Improved plaster-cast reproductions with easy release of the case from wood or metal pattern and core boxes is reported with the addition of Lubikold plaster release to the plaster release lubricant normally used.

The white powder compound release agent may be used to release plastic as well as plaster.

When pouring some materials, Lubikold can be rubbed dry into the molds. Because of its fine texture, it serves as a coating in the mold, reducing moisture and preventing gas pockets.

When using modeling clay, sticking can be avoided by rubbing Lubikold dry on the surface of the clay and dusting it in the cavity.

Lubikold Co., 516 Bergen St., Brooklyn 17, N. Y. **T-7-12**

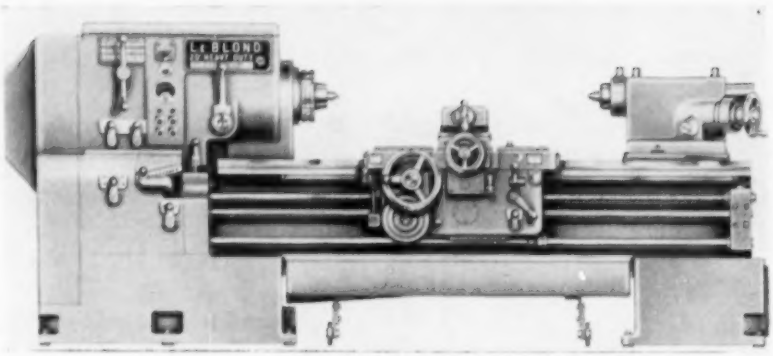
Heavy-Duty Lathe

This 20 in. heavy-duty engine lathe, designed to use 40 hp effectively, will permit maximum efficiency with ceramic and carbide tools. Short, heavy shafts

and fine-pitch precision-ground gears deliver power efficiently to the spindle with minimum no-load horsepower. At 10 rpm a cut can be taken as deep as ½ in. in 16 in. diameter work, feeding at 0.063 ipr.

There are 36 speeds, from 10 to 1300 rpm in geometric progression. Selections are made in fine increments, particularly in the low range.

In the 2-speed tailstock, spindle travel is geared for conventional and low speed. Tailstock can be moved by power. Worm-and-rack construction puts the handwheel at a convenient angle to the operator, provides long travel and positive safety lock against thrust, and provides full-length support of spindle, even when extended.



Controls are designed for operator convenience. Speed selection is color coded; spindle is sensitively controlled by means of electric clutch brake; 4-directional power rapid traverse is controlled by a single lever. There are built-in horsepower meter, chasing dial integral with apron and quick-setting diameter reading dials on crossfeed.

The R. K. LeBlond Machine Tool Co., Madison and Edwards Rds., Cincinnati 8, Ohio. **T-7-13**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Snap Gage

Designed to speed inspection operations, this dial indicator snap gage has a retractable anvil to provide fast operation. Because it is portable, the tool can be used to inspect work at the machine, as well as in the toolroom and quality control section. In the illustration the gage is being used to check the rolled spline on an axle shaft. A master setting gage is in place, along with a section of the splined axle shaft. The gage is also used widely to check gear tooth pitch diameters.

The gage is designed to assure posi-

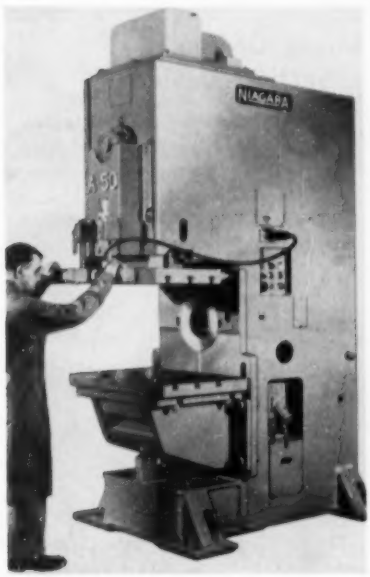
tive alignment and squareness throughout. There are no pivots, bearings or cams in its internal construction; the only wear points are on the carbide anvils and in the indicator.

The device is available in size ranges from ¼ to 5 in., with carbide anvils to suit individual job requirements.

Lincoln Park Industries, 1719 Ferris Ave., Lincoln Park 25, Mich. **T-7-14**

Adjustable-Bed Press

Adjustable-bed presses designed for easy portability in connection with or beyond the production line are available for the automotive and appliance industries. Specialized controls and devices are recessed in the sidewalls or



completely housed behind flush panel doors. Air control panel and combination motor-press control panel are enclosed in the back of the press. Specially equipped for secondary operations between automated presses in the production line, this press achieves fast, safe, efficient output.

Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y. **T-7-15**

Slip Coupling

Light-duty L2 slip coupling for directly connecting two shaft ends has metallic friction plates. The coupling is available with bore dimensions of ½, ⅝ and ¾-in. diam. in either member. Physical dimensions are 2⅜- in. diam. x 1⅞-in. total shaft length.

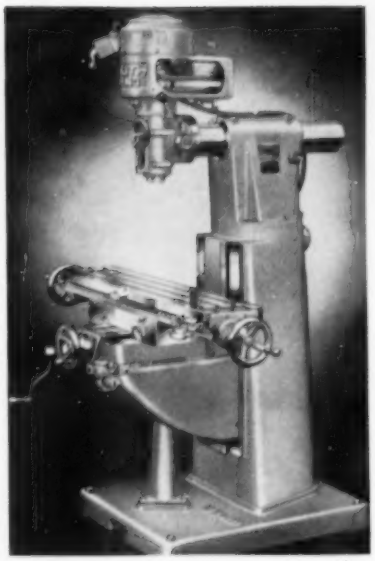
The coupling is available with disk spring assembly, Type 323 and adjustable torque range up to 9 ft-lb maximum

as well as the more sensitive Type 323A which has coil springs to provide the friction-plate pressure. The size and number of coil springs can be varied and the coupling can be adjusted to suit any torque range from 0 to 7.3 ft-lb.

The 1.2 Type 323 coupling is intended for general application to provide overload protection between small motors and reducers, conveyors, feeding mechanisms, packaging equipment and similar machines. Type 323A assembly is recommended for installation where the torque must be regulated very closely and for any application involving 2 ft-lb torque or less.

The Hilliard Corp., 100 W. Fourth St., Elmira, N. Y. **T-7-16**

Vertical Milling Machine



Head of this vertical-spindle precision milling machine swivels 360 deg on the flanged end of the overarm for milling, drilling or boring at any angle. A substantial key with tapered gib prevents the overarm from turning in the column bearing, thus the head can be moved transversely without affecting its angular setting. Vernier graduations reading in minutes and worm gear adjustment permit fast, easy setting of head angle. The 4½ in. diameter overarm has 15 in. rack and pinion cross movement, and can be locked rigidly at any point.

Table of the machine is 9 in. wide and is available in 32 and 42 in. lengths providing 20 or 30 in. longitudinal travel respectively. Vertical adjustment of table is 18 in. Maximum distance from table to spindle is 20 in. and maximum distance from spindle to column is 20 in. Length of table feed is regulated by adjustable stops. Measuring trays with dial indicators are available for precision positioning of the table with both the cross-feed and longitudinal feed screws.

Spindle has No. 30 milling machine taper with ¾ in. maximum collet capacity. Individual tool holders have up to 1 in. capacity. Spindle has 4 in. vertical travel with lever for rapid movement and handwheel for slow feed. Micrometer depth stop and positive quill lock are provided. Eight spindle speeds range from 90 to 2500 rpm with ¾ hp, 1200 rpm motor or 135 to 3750 rpm with 1 hp 1800 rpm motor.

South Bend Lathe, South Bend 22, Ind. **T-7-17**

Micro Divider Setting Device

Accuracy in setting to 0.001 in. is assured by this British-made Leytool micro divider setter for draftsmen, lofting engineers, layout men and toolmakers.

The rule is finished in hard chromium plate with a nonscratch surface, providing adequate protection from rust and corrosion.

U. S. agent is Air Transport Equipment, Inc., Albany Ave., Amityville, N. Y. **T-7-18**

ID Measuring Instrument

Internal measuring instrument has an optical vernier to provide quick, easy bore measurements. There is no need for critical alignment or special operator skill or "feel."

The tool, called the Opto-Mike, is inserted at an angle into the bore, while the anvil is retracted; the measuring anvil is released and Opto-Mike is swept once a few degrees; then Opto-Mike is carefully withdrawn and the true measurement is easily read on the 23-power optical vernier.

Based on the two-point measuring principle, the instrument can make two readings at right angles to each other, thus providing a precise measurement

of "out-of-round."

The Opto-Mike is available in matched sets for internal measurements from 0.800 to 6.000 in.

American Gauge Corp., 575 Bloomfield Ave., Verona, N. J. **T-7-19**

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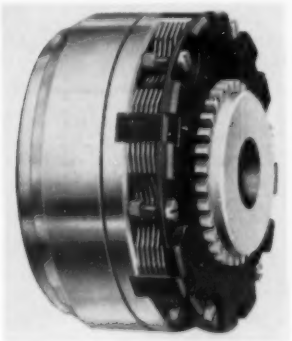
Magnetic Clutch

Design features of this magnetic clutch include comparatively small dimensions, complete isolation of the magnetic assembly from the integral mechanical parts, and compact, precision assembly of all component parts. It is furnished in stationary field or brush types and for either wet or dry operation.

It provides fast operating speed in both engagement and disengagement. Decay time and residual drag are minimized by effective isolation of the mag-



netic assembly from the clutch friction components.

Complete torque control is provided through push buttons, relays, or limit switches, etc. under all rated conditions. The clutches, which have a wide range of bore sizes, are self-contained, and do not produce axial thrust on other machine parts. Action time is not affected by shaft speeds and the entire unit has high heat-dissipation characteristics. They are available in sizes ranging from 2 to 13 in.

Fawick Airflex Div., Fawick Corp., 9919 Clinton Rd., Cleveland 11, Ohio. **T-7-20**

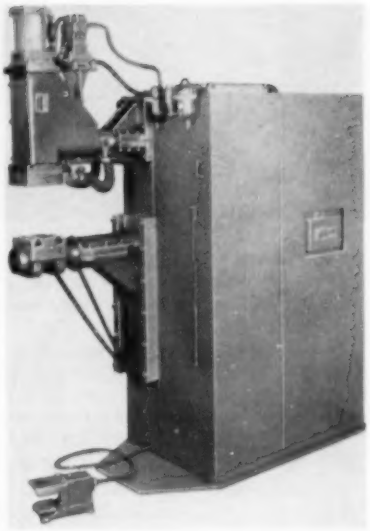
Welder

Roller head, press type, combination spot and projection welder are designed for compactness. Arms are placed off-center with the controls installed next to the arms and within the welded chassis frame. Arms can be installed left or right of centers. This makes it possible to conveniently weld large irregular-shaped pieces that fit naturally around the corner of the machine. A machine with right-hand-mounted arms may be installed immediately adjacent to one with left-hand-mounted arms to bring the points within 9½ in. for sequence welding operations.

Design permits extension of the arms to give up to 30 in. throat depth. Vertical adjustment of the lower arm up to 15 in. is provided and current characteristics are unchanged when the arm is raised or lowered, except on air gap, since the transformer is connected directly to the arm support casting.

Head on the upper arm is demountable in only a few minutes and may be replaced with special adaptations.

Welders are water-cooled, with open or closed circuits, and provide un-



usually cool operation. They are available in two standard sizes: 30, 50 and 75 kva with 1000 psi at 80-lb line pressure and 75, 100 and 150 kva with 2300 psi at 80-lb line pressure.

Allied Welder Corp., 8700 Brandt, Dearborn, Mich. **T-7-21**

Threading Machine

A 5C Landmaco single-spindle threading machine, designed for precision threading of small diameter workpieces, will produce threads to Class 3 and 4 tolerances on a production basis and has a #4 to 5/8-in. range.

Available with or without lead screw feed, it is equipped with tangential chasers which can be ground for 80 percent of their original length. Air-operated carriage front, air-operated carriage return, automatic or manual work stop and a variety of special carriage fronts for holding difficult-to-grip

workpieces can be supplied.

Eight spindle speeds, ranging from 150 to 1000 rpm are provided by a geared headstock and four step cone V-belt pulley drives. Higher or lower speeds are available for special use.

The carriage has a nominal 4½-in. travel. Total available thread length varies slightly with carriage front, die head chaser holders and auxiliary equipment supplied. The carriage front is adjustable both horizontally and vertically to assure precise work alignment with the die head.

A lead screw is recommended where maximum thread accuracy and close lead tolerances are to be maintained. The lead screw is changed for each different pitch thread to be produced.

Landis Machine Co., Waynesboro, Pa.

T-7-22

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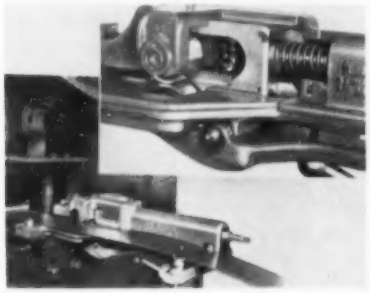
Punch Press Feed

An automatic punch press feed, called the 12-in. Rol-Di-Feed, is a self-contained, cam-driven feed that can be mounted to feed in any direction for any type of die, piercing, blanking, compound, progressive or draw.

Smooth and silent in operation, the unit is mechanically operated and temperature changes do not affect its accuracy. With feed and cam properly mounted, it is ready for operation.

It requires no connection to the crank-



shaft of the press and utilizes almost all of the 360 deg of press shaft rotation, feeding both on the upstroke and on the downstroke. This arrangement permits stock feeds up to 12 in. per cycle, even on deep drawing or forming dies where only a fraction of the total press stroke is available for feeding purposes.

The 12-in. Rol-Di-Feed handles paper, plastic, fiber, or cold-rolled steel and other materials, in thicknesses ranging from 0.003 to $\frac{3}{16}$ in. Open side design accommodates stock of almost unlimited width.

The photograph illustrates the feed conventionally mounted on a punch press. Insert photo shows the two pre-

cision gears which operate in sequence, feeding one-half of stock on press upstroke, the remainder on the downstroke. At the end of individual forward travel, each gear locks against reverse rotation, preventing any backward movement of the stock being fed.

The feeds can be mounted to feed from left to right, right to left, front to back, back to front, or at any angle.

H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass. **T-7-23**

Ultrasonic Degreaser

Compact, small-scaled, bench model ultrasonic degreaser, the DV-18 has a work area 9x9x6 in. high and a capacity of 100 lb per hour minimum. Over-all

size is 33x15x24 in. high, total weight 75 lb.

This DV-18 Ultrasonic Degreaser comes complete with all accessory equipment to assure precision work.

Ramco Equipment Corp., Div. of Randall Mfg. Co., Inc., 1373 Lafayette Ave, New York 59, N. Y. **T-7-24**

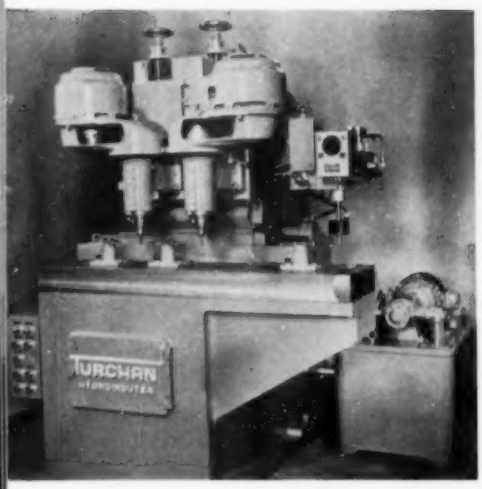
Router

The 2-spindle tracer controlled Hydro-Router is designed for intricate external or internal contouring. A tracing control can be added to provide combination profiling and contouring.

Equipped with the Hydro-Magnetic tracer control and two spindles this machine will acommodate a wide variety of work. The tracer produces a closed 360 deg contour automatically through the rotating, magnetized stylus which clings to the template and requires minimum operator attention.

Each spindle has a separate 2 hp motor and is adjustable to facilitate repositioning of the vertical height when cutters are changed.

The vertical slide, hydraulically actuated and controlled by a servo valve, provides four turret stop positions for contouring at various depths and profiling when the machine is equipped with a two dimensional tracer control.



Large workpieces can be set up to overhang the 56½ x 14½ in. stationary table while ends or section are machined.

Spindle speeds range from 130 to 11,750 rpm to permit machining of tough, heavy metals, fast machining of the light, nonferrous metals and grinding operations.

Range during single spindle operation is 24 in. longitudinal, 12 in. cross or 8 in. vertical. During double spindle operation range covers 12 in. longitudinal, 12 in. cross and 8 in. vertical. Feed rates are 0 to 40 ipm.

Turchan Follower Machine Co., 26950 Van Born Rd., Box 6055, Dearborn, Mich. **T-7-25**

Bore Gage

High-precision bore gages, called Diatest, measures hole diameters from 0.062 to 0.787 in. at depths up to 3⅛ in.

Easily operated by unskilled workers, it measures to 0.0004 in., out-of-round, tapered or barrel-shaped bores.

All units and sets in the line overlap in size to insure complete range. The measuring units are slit-ball type, made of hard chromium-plated steel. When instrument is not in use, slit-ball unit automatically opens to maximum size.

Rough setting is achieved by moving dial indicator vertically in its holder; fine setting by rotating dial to zero. All sets are supplied with master ring gages of corresponding sizes as comparators. Dial indicators are supplied in 0.0001 or 0.0005 in. readings.

Foster Supplies Co., 6122 Milwaukee Ave., Chicago 30, Ill. **T-7-26**

Double-Action Heads For Shapers

This two position cutting head permits cutting two different pitch diameters on one part in a single setup of Shear-Speed gear shapers in the 1800 series. Two sets of teeth are cut in sequence with the head moving to two stop positions. Differential tool feed cuts the varying pitch diameters.

In operation, as set up for an automotive shifting ring having two sets of eight teeth, in-line but on pitch di-

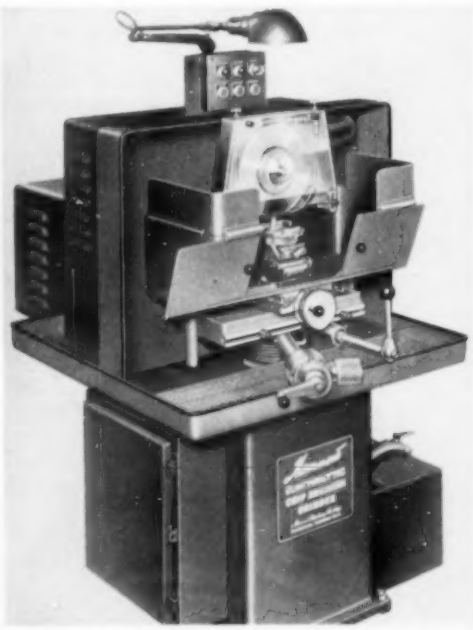
ameters different by 0.004 in., the part is manually loaded and hydraulically clamped. All tools are fed radially into the work simultaneously. The deeper teeth are cut first. End of the first operation automatically actuates the head into the second position where it is locked for the second cut. For both operations, 60 strokes at a surface feed of 20.9 fpm is used. Production rate is 60 parts an hour.

Downfeed of the cutter head is controlled by an eccentric relief cam and position-held by a double hydraulic cylinder arrangement. Lock action is automatic.

Michigan Tool Co., 7171 S. McNichols Rd., Detroit 12, Mich. **T-2-26**

Chip Breaker

This electrolytic chip breaker grinder for 6 and 10 in. diameter wheels provides smooth, fast, single-pass, full-depth grinding. The heavy spindle is



dynamically balanced. Tapered spindle nose assures true wheel mounting.

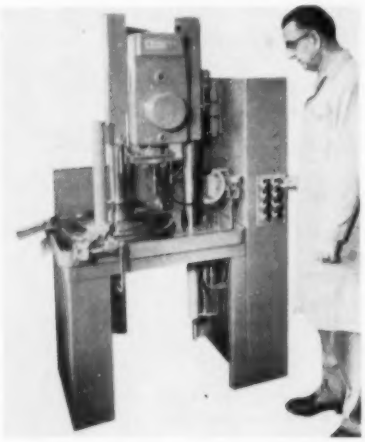
The table reciprocates on hardened and ground ball bearing ways and the any-angle vise accommodates tools up to 2½ in. wide. A built-in mist collector returns captured coolant to the pump and tank unit in the base.

Hammond Machinery Builders, 1661 Douglas Ave., Kalamazoo, Mich. **T-7-27**

Honing Machine

Model #10A1 vertical honing machine, one of four models developed from two basic machines for small-diameter work, permits manual or automatic honing of bores from ⅜ to 2 in. in diameter. These machines are designed with mechanical and pneumatic actuation.

Floor area required, including electrical panel, is 32 x 45 to 42 x 63 in. for the largest model. The basic machine is designed to provide for adding automatic equipment such as a rotary index table, magazine feed, pregaging, bore-to-bore sizing by fluid, plugmatic sizing or time cycle, pneumatic hone expansion with automatic rapid expansion, feed and collapse, postgaging, sorting and ejection. The machine will automatically shut down if errors are continuous or when stones are worn.



Simplicity is provided by all-mechanical reciprocation and rotation of head and spindle. On the manual models 10M1 and 15M2, the complete cycle is controlled by two limit switches. Automatic Models 10A1 (illustrated) and 15A2 require only four limit switches.

The Model 10A1 has a ⅜ to 1 in. inside diameter range with a 10 in. swing. Maximum spindle travel is 2½ in. with a 6 in. lift-out stroke. Power is supplied by a ¾ hp motor. Model 10M1 has the same capacities but is furnished without automatic attachments. The 15A2 and 15M2 have a ½ to 2 in. ID range with a 15 in. swing. Maximum spindle travel is 6 in. with an 8 in. lift-out stroke.

Barnes Drill Co., Rockford, Ill. **T-7-28**

Surface Plate Calibrator

Any plane surface can be easily and accurately calibrated with this instrument by untrained operators. In effect, the instrument locates a theoretically perfect plane over the surface plate. Indicator readings are taken between the perfect plane and the surface plate and readings are recorded on a chart. No calculations are required.

The unit, called the Planekator, has an indicator base which will take any indicator made to American Gage Design AD2 dimensions. Estimating 1/5 of a graduation makes it possible to calibrate a surface to 10 millionths.

Rahn Granite Surface Plate Co., 635 N. Western Ave., Dayton, Ohio. **T-7-29**

Oil Filter

A line of oil filters, designated the R Series, incorporates a throw-away cartridge. Service of the simplified three-piece construction is easy. The series is designed for the filtration of lubricating and fuel oils used in internal-combustion engines, for oil-bath air filters and for the filtration of various types of industrial oils, fuel oils, solvents and coolants used in the manufacturing and chemical process industries.

The Hilliard Corp., Elmira, N. Y. **T-7-30**

Indexing Table

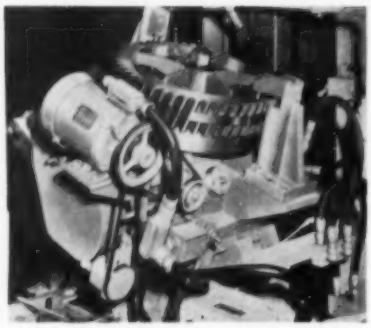
This indexing table provides positive index to tenths, no backlash, mechanical self-locking, angular setting (by cradle mounting) and high flexibility in use.

The fixture, designated the Positive-Index table, may be applied to a broad range of machine tools. For applications like broaching, it provides long tool life, good finish, and stands up

under hard service.

The table is particularly suited for jet-engine, turbine, missile or similar high precision production. It is available in diameters of 11, 18 and 28 in.; all offer an infinitely adjustable range of index from 21 to 250 divisions of a circle. Index changeover is simple.

Indexing is controlled by a positive pin-locked single-revolution index plate. Rotation occurs only during index when the opposed control worm allows the drive worm to move. A continuously running motor does double duty;

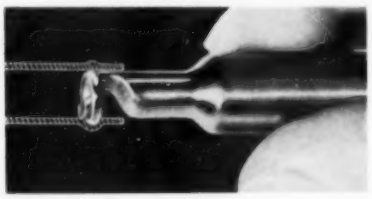


it provides the indexing power and takes up all backlash in the unit through two slip-type clutches. All gears lock when the index pin locates into the plate.

Colonial Broach and Machine Co., P. O. Box 37, Harper Station, Detroit 13, Mich. **T-7-31**

Fitting For Flexible Tubing

Designed for easy installation in all types of flexible tubing, particularly plastic and rubber, this fitting requires no welding, special adhesives, or threading. It is engineered to assure a joint



as strong as the tube itself and does not reduce ID or flow.

The Danco fitting (elbow, tee, 90 deg or special design) is slipped on tube. Using the special ring holder, a noncorrosive ring is inserted into the tube. Tightening the molded nylon Danco fitting completes the operation. The joint is sealed-tight, strong, and lightweight.

Danielson Mfg. Co., Danielson, Conn. **T-7-32**

Tracer Lathe

Design of the Hydraguide tracer lathe provides automatic turning of multiple-diameter shafts and contoured workpieces while retaining qualities of a standard lathe. None of the tracer mechanism need be removed for manual usage. The tracer is locked out merely by retracting the tracer slide and pushing a single control button.

Entire tracer mechanism is mounted on the carriage with all controls, template, tracer finger and tools on the operating side of the lathe. This compact design does not interfere with standard lathe operations and it does provide short hydraulic linkage assuring maximum sensitivity in tracer control.

The Hydraguide will automatically turn multiple-diameter shafts, shoulders, tapers, necks and contours. It can also be employed for many boring and facing operations.

The hydraulic tracer control will accurately reproduce template shape without need for special operator skill. The swiveling tracer is normally set at a 45 deg angle to the center line of the lathe allowing square shoulders to be machined at high feed rates without

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-7-225-1	Ace Drill Bushing Co., Inc.	**Drill Bushings**—New 1957 catalog lists both finished and unground list prices, technical data and name of nearest dealer. (Page 224-225)
A-7-262	Allegheny Ludlum Steel Corp.	**Tool Steels**—Blue sheet folder gives handling and shop treatment details on Ottawa 60 tool steel. (Page 262)
A-7-235	The American Brass Co.	**Brass Forgings**—Publication B-9 describes Anaconda die-pressed brass forgings (Page 235)
A-7-13	American Drill Bushing Co.	**Drill Bushings**—Catalog contains data on bushings and 3-D method of ordering. (Page 13)
A-7-12	The American Tool Works Co.	**Radial Drills**—Bulletin No. 328 describes new model 32 speed Hole Wizard radial drill. (Page 12)
A-7-151	Armstrong-Blum Mfg. Co.	**Hacksaw Blade**—Cutting tool bulletin describes Marvel high-speed edge hacksaw blade. (Page 151)
A-7-191	The Atrax Co.	**Cutting Tools**—Catalog contains standard reference on solid carbide tools and case histories. (Page 191)
A-7-228-1	Barksdale Valves	**Air Valves**—Bulletin A-5 contains data on Shear Seal 4-way valves 0 to 250 psi. (Page 228)
A-7-46	Barnes Drill Co. Filtration Div.	**Separator**—Barnesdrill magnetic coolant separator described in catalog 500-G. (Page 46)
A-7-239	The Bellows Co.	**Controlled Air-Power Devices**—Package work units, work and tool feeders, holding devices, air motors and controls described in Bulletins ML-3 and BM-25. (Page 239)
A-7-45	E. W. Bliss Co. Die Supply Div.	**Die Supplies**—Line of die makers' supplies described in Catalog 70-A. (Page 45)
A-7-159	Brown & Sharpe Mfg. Co.	**Milling Cutters**—Brown & Sharpe catalog shows over 2300 High-Speed Steel Tools and Accessories. (Page 159)
A-7-224-1	Cerro de Pasco Sales Corp.	**Materials**—Bulletin contains data on low-temperature melting alloys. (Page 224)
A-7-62	Cincinnati Grinders, Inc.	**Grinders**—Catalog No. G-640-1 describes Cincinnati Filmatic Nos. 2, 3, 5 and 6 centerless grinders. (Page 62)
A-7-238	The Cleveland Crane & Engineering Co.	**Shears**—Catalog No. 2011 gives construction and engineering details. (Page 238)
A-7-177-1	Arthur A. Crafts Co., Inc.	**Carbide Form Tools**—Catalog available on "Complete Carbide Tooling for Automation." (Page 177)
A-7-27	Detroit Broach & Machine Co.	**Broaching Machines**—Bulletins available describing vertical twin ram, vertical single ram, vertical pull down, horizontal internal, horizontal continuous and hydraulic presses. (Pages 26-27)
A-7-233	Eastman Kodak Co.	**Projectors**—"Projection Gaging with Kodak Contour Projectors" describes Kodak simplification of measurement inspection problems. (Page 233)
A-7-67	Ehrhardt Tool & Machine Co.	**Gages and Dies**—Booklet "Triple Plus" describes the Ehrhardt line of precision gages, dies and fixtures. (Page 67)
A-7-175	Speedgrip Chuck Division Ernest, Holdeman & Collet, Inc.	**Chucks**—Bulletin No. 23 gives full description and technical details on Speedgrip "Cyl-Chucks." (Page 175)

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A-7-182	Firth Sterling, Inc.	**Cutting Tools**—Catalog MTI-3 gives "The Modern Approach to Economical Carbide Tooling." (Page 182)
A-7-273	Heller Tool Co.	**Hack Saw Blades**—Catalog gives information on sizes and types of blades. (Page 273)
A-7-216	Jones & Lamson Machine Co.	**Comparators**—Catalog 402-C describes Jones & Lamson optical comparators. (Page 216)
A-7-40	Metal Cutting Tools Inc.	**Cutting Tools**—Brochure gives specifications of new Metcut Pin-Mount design core drill. (Page 40)
A-7-68	Metal Carbides Corp.	**Die Steel**—Catalog 56-G contains data on Talide metal carbides (Page 68)
A-7-56	Michigan Tool Co.	**Gear Hobber**—Bulletin TH-33 contains information on Michigan's tandem gear hobber. (Pages 55-56)
A-7-21	The Motch & Merryweather Machinery Co.	**Saws**—A pocket-sized guide to sawing operations contained in M & M circular sawing handbook. (Page 21)
A-7-207	The National Acme Co.	**Taps**—Collapsible taps for rotary or stationary spindle machine described in Bulletin DT-52. (Page 207)
A-7-232	National Broach & Machine Co.	**Honing**—Bulletin H 57-2 discusses reducing the cost of silencing noisy gears. (Page 232)
A-7-39	National Tool Co.	**Special Tools**—Catalog shows National Tool Co.'s complete line of special tools for the metalworking industry. (Page 39)
A-7-31	Niagara Machine & Tool Works	**Presses**—Bulletin 56 gives design description specifications on front-to-back crankshaft OBI press. (Pages 30-31)
A-7-245	The Ohio Crankshaft Co.	**Induction Heating**—Catalog shows "Typical Results of Tocco Induction Heating for Forming and Forging." (Page 245)
A-7-47	Ortman-Miller Machine Co.	**Cylinders**—Bulletins 101A and 105 describe removable rod gland cartridge, exclusive with the OM series T-H hydraulic cylinder. (Page 47)
A-7-246-3	Petz-Emery, Inc.	**Indicators**—Catalog D describes Em-re line of dial indicators. (Page 246)
A-7-218	Seibert & Sons, Inc.	**Tool Control**—Seibert control system described in Circular B-10. (Page 218)
A-7-44	Unbrako Socket Screw Div. Standard Pressed Steel Co.	**Cap Screws**—Form 2193 contains technical data on socket screws with Nylok self-locking device. (Page 44)
A-7-54	The Taft-Peirce Mfg. Co.	**Gaging**—Booklet "6 Special Ways To Air Gage for Lower Costs, Higher Production" shows typical T-P CompAIRamatic installations. (Page 54)
A-7-256	U. S. Tool Co., Inc.	**Rolled and Slide Feed**—Bulletins 80-T and 95-T show advantages of using U. S. Automatic pressroom equipment. (Page 256)
A-7-254-2	Vibratory Feeder Co. Div. of Automation Devices, Inc.	**Special Equipment**—Parts feeding information available in V F C Sales Engineers Data Book. (Page 254)
A-7-178	Wales Strippit Co.	**Die Supplies**—Bulletin No. 26-F describes Strippits for more versatility in die making. (Page 178)
A-7-264-2	Ward Machinery Co.	**Punches and Dies**—Catalog No. 154-AC describes standard punches and dies for foot and power presses. (Page 264)
A-7-158	Waukesha Cutting Tools, Inc.	**Cutting Tools**—Catalog describes and illustrates the full line of Waukesha tools. (Page 158)
A-7-66	Wiedemann Machine Co.	**Presses**—Bulletin 201 describes Wiedemann turret punch presses. (Page 66)

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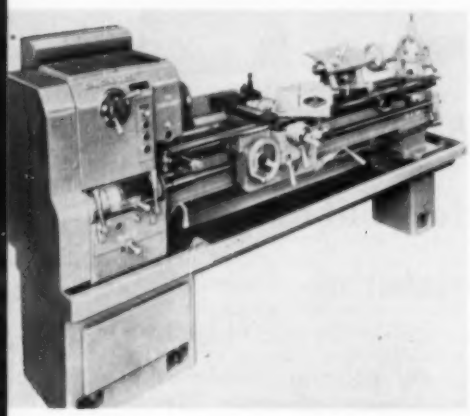
interruption of lateral carriage movement.

Hydraguide tracer lathes are built in 15 and 18 in. swing sizes, and center distances from 30 to 114 in. Motor size is 5 hp. Twelve spindle speeds in geometric progression from 37 to 1470 rpm can be selected by three-lever, direct-reading, color-match dials; 48 thread and feed changes afford a carriage feed range from 0.0019 to 0.1215 in. per



spindle revolution and a thread range of 1½ to 92 threads per inch with provision for quick conversion to metric threads.

The tracer mechanism is also available for 15 and 18 in. Model LE Tray-Top engine and toolroom lathes now in service.

Cincinnati Lathe & Tool Co., Cincinnati 9, Ohio. **T-7-33**

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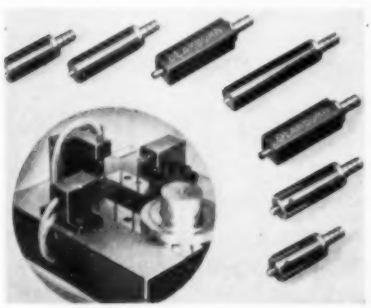
Air Gage Cartridges

Multiple-amplification contact air gage cartridges are guaranteed as to accuracy and linearity, and permit interchangeable use on any make or type of air gage instrument.

They are useful for checking hard-to-reach surfaces and relationship dimensions involving outside diameters, inside



diameters, steps, eccentricity, concentricity, flatness, parallelism and similar gaging applications. Their interchangeable use through multiple-amplification ranges does away with need for using a specific cartridge for a specific tolerance range.

The line includes normal, short normal and reverse cartridges which can be used interchangeably for 1500:1; 3000:1 and 6000:1 amplification ranges. A long range, low-amplification cartridge for 15,000, 30,000 and 60,000:1 amplification ranges, plus a square-body type cartridge for simple fixturing applications, are offered as standard items.

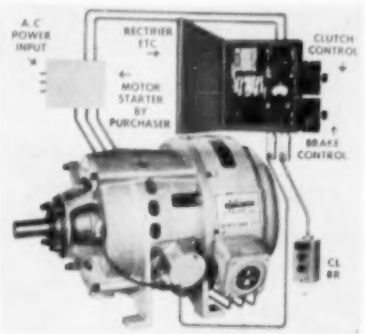
The cartridges are equipped with tungsten carbide gaging tips and the cylindrical styles are optionally available with external threads.

Air Gage Div., Dearborn Gage Co., 22038 Beech St., Dearborn 8, Mich. **T-7-34**

Package Drive

Fast or slow starts with acceleration, deceleration and/or stops in automatic cycles up to 30 per minute are provided by the package motor-clutch-brake drive.

The unit is compactly designed around an axial air-gap motor closely coupled to magnetic clutch and brake components. It is available in sizes from 1½ through 15 hp, all with constant torque. Standard motor speeds



range between 600 and 1800 rpm. Maximum diameter is 18 in. with over-all drive-length no greater than 30 in. The drives are available as standard units with d-c rectification incorporated and with special control cabinet for automatic cycling.

The units are suitable for operating machinery under continuous or intermittent service, with almost any desired combination of automatic stop-start or speed-up, slow-down regulation. Clutch magnets produce maximum torque on d-c voltage of from 6 to 12 volts and 3-4 amp. of current.

Ericsson Merritt, Inc., 503 Pine St., Lockport, N. Y. **T-7-35**

After thorough research, development and tests . . .

The very first in its field!

NewMet*

by NEWCOMER

Neither a ceramic... nor a tungsten carbide... but an all-new high-velocity metallic cutting material

△ □ ○ NewMet by Newcomer has opened a new field of high velocity cutting in metal-working. A product of Newcomer research and development over the past ten years, this new material is capable of cutting performances beyond the capacities of present machines. Its extreme hardness (Rockwell "A" 95), combined with a comparatively high strength, gives NewMet the ability to perform superbly at both normal carbide cutting speeds or at speeds within the range of ceramic-type cutting tools.

Typical NewMet* PERFORMANCE DATA

1 Turning Low Carbon Steel			2 Turning Medium Carbon Steel			3 Turning Stainless Steel (Magnetic Type)		
SPEED	DEPTH OF CUT	FEED	SPEED	DEPTH OF CUT	FEED	SPEED	DEPTH OF CUT	FEED
1000 to 1500 SFPM	.001" to .090"	.001" to .012"	900 to 1200 SFPM	.001" to .090"	.001" to .012"	800 to 1500 SFPM	Up to .100"	.007" to .010"

Economize now with high-velocity cutting . . . use *"Years Ahead"*

NewMet* by NEWCOMER

NewMet is available in "Throway" triangular, square and round inserts, and solid cylinders. Call your nearest Newcomer representative for complete data, or contact

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FIELD notes

Manpower Shortage Slows Patent Processing

Adoption by industry of new products and processes often is slowed down or even deferred because of present delays and consequent uncertainties in patent status. The problem grows out of the need by the Patent Office for engineers and scientists to serve as patent examiners. According to the New York Patent Law Association, while delays in processing of patent applications in the Patent Office have been somewhat reduced during the past year, it still takes about 10 months before a new patent application is first examined, and an average of 3½ years before a patent is issued.

This situation handicaps the larger corporation, can be critical for an individual inventor, and is of deep concern to the small businessman whose operations may revolve around patented products and processes.

More patent examiners, of course, is the key to the bottleneck. These are technically trained men and women who evaluate applications for patents in technical fields to determine whether the new suggestions are novel and whether invention is involved. Although all areas are of concern, electrical engineers and electronics specialists are of prime need.

The office is searching for men and women holding college degrees in engineering or applied science or a degree with a major in chemistry or physics, or with certain combined credits in these fields.

acquisitions

Alva Allen Industries has purchased Canadian and American patent rights of the Marvel milling attachment for lathes from the designer, Michael Hanna. The attachment is easily installed on practically any conventional lathe, enabling the performance of many milling operations.

v v v

Termite Drills, Inc. has acquired manufacturing and distributing rights to the Sta-Put drill press clamp. Made of aluminum alloy, the safety device is designed to hold any shaped workpiece securely.

v v v

Federal Wire & Cable Co., Ltd., of Guelph, Ontario, has been acquired by H. K. Porter Co., Inc. The transaction was carried out by H. K. Porter Co. (Canada) Ltd., a wholly-owned subsidiary.

v v v

Assets and business of the A. P. Schraner Co. located in Cleveland, as well as the assets leased by that company, have been purchased by The Foote-Burt Co. Total cost of the transaction amounted to approximately $285,000. Although intentions are to operate in the present building, Foote-Burt intends ultimately to combine the operation in its main plant.

v v v

Business and assets of The Lima Electric Motor Co. have been acquired by a wholly-owned subsidiary of Consolidated Diesel Electric Corp. The acquisition is part of a program of diversification being carried on by the company.

new endeavors

Miller Associates, a firm recently formed by W. R. Miller, will specialize as management consultants in industrial, electronic and technical executive procurement. The company's office is located at 742 S. Hill St., Los Angeles. Prior to forming his own company, Mr. Miller was vice-president in charge of manufacturing of Longren Aircraft Co.

v v v

The Metal Removal Center has been established at Spring Garden Institute in Philadelphia as a consulting service for industry. Its purpose is to assist in solution of difficult metal removal problems and application of latest cutting elements such as ceramics and cermets to low machinability jobs. The Center also conducts a seminar intended for industrial executives interested in having latest developments in cutting techniques and materials evaluated for policy making purposes.

v v v

Union Carbide Corp. is planning to build an ore preparation plant at Warwick, Va., for processing manganese and chromium ores from various parts of the world. The plant will be operated by Union Carbide Ore Co., a division of Union Carbide. It will grade and classify approximately 30,000 tons of ore a month. Operations are expected to begin on a limited scale in the spring of 1958.

v v v

An ultrasonic drilling and grinding department has been established by Zenith Optical Laboratory. The department utilizes a technique employing abrasives in liquid suspension to machine very brittle or hard materials, such as ceramics, carbides, ferrites, quartz, glass bonded mica, etc.

v v v

Dana Corp. has activated an Aircraft Dept. which will operate as part of Dana's Pottstown Div. The new department will function essentially in manufacture of aircraft type universal joints and propeller shafts.

v v v

Formation of Olin Mathieson International Corp. as a wholly owned subsidiary was announced by Olin Mathieson Chemical Corp. Henry A. Arnold was named the new corporation's president to be responsible for all of Olin Mathieson's overseas activities.

competitions

Twenty-six awards will be made in three separate divisions of the Machine Design Award Program for papers describing designs which make a significant use of arc welding. Top prize is $5,000. The three areas of interest are: industrial processing machinery; construction and mining machinery; and jigs, fixtures and tooling. Deadline for the competition, which is sponsored by The James F. Lincoln Arc Welding Foundation, is July 15, 1957. Information is available from the Foundation, P. O. Box 3035, Cleveland 17, Ohio.

v v v

The second New Ideas in Instrumentation contest calculated to search

for outstanding technological advances in the field of automation is again being conducted by the Instrument Society of America. Entries, which are not limited to members of the ISA, will be judged on novelty, practicability and adaptability. Deadline for entries is July 15. Obtain entry blanks from S. D. Distelhorst, Director of Membership Relations, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa. Cash awards will be made to winners.

name changes

Pennsalt Chemicals Corp. is the new name of Pennsylvania Salt Mfg. Co. Shareholders and members of the board felt the new identification better describes the present purpose of the company while it retains a link with the name under which the firm has done business for more than 106 years.

V V V

Seaboard Coil Spring Div. is the new designation for Associated Spring Corp.'s West Coast operation in Gardena, Calif. The new name was chosen to reflect more accurately on the broad range of types of precision mechanical springs supplied by the division.

V V V

Stockholders of International Metal Industries, Ltd., have voted to change the firm's corporate name to John Wood Industries Ltd.

expansions

A $1.5-million expansion program has been inaugurated by Crucible Steel Co. of America for Vacuum Metals Corp., an operating division of the company's Sanderson-Halcomb Works. The program will double the company's capacity for producing high purity vacuum-melted materials. A new vacuum induction furnace melting shop building and a metallurgical-chemical laboratory building are included in the program.

V V V

A $5-million plant-expansion program, scheduled for completion in stages by 1961, is under way for the Scintilla division of Bendix Aviation Corp. It will add about 200,000 sq ft to the present plant space in Sidney, N. Y.

V V V

A 75 by 530 ft. building has been added to the main plant of National Automatic Tool Co., Inc., increasing manufacturing space by 30 percent. This latest step in Natco's plant ex-

pansion program provides more assembly area, makes possible more rapid shipment of finished products and also makes room for newly purchased production equipment.

V V V

Pratt & Whitney Co. Inc. has announced a major expansion program at its Rochester, N. Y., branch office facilities. New, enlarged quarters are being completed in the city's Linden Industrial Park area. It will provide a 100 percent increase in square-foot area of the branch's present facilities.

V V V

Program of expansion which will increase the capacity of its Pittsburgh, Pa. steel service plant by more than a third has been announced by Joseph T. Ryerson & Son, Inc. Cost of the building, machinery and other operating equipment is estimated at approximately $1-million. Construction is to begin this year with completion scheduled in 1958.

V V V

An expansion in facilities for automation research and development has been made by Press Automation Systems, Inc. New research facility at 25418 Ryan Rd., Centerline, Mich., was designed to meet needs of the stamping industry now making extensive use of automation concepts and devices.

V V V

Plant No. 4 has been completed for O K Tool Co. The new machine shop provides 16,500 sq ft of floor space for company expansion.

new offices

New offices for Newcomer Products, Inc., have been opened at 1820 E. 79th St., Chicago 49, Ill.

V V V

New sales office for F. J. Stokes Corp. has been opened in Atlanta, Ga., to serve industry in the southeastern area of the country. The office is located at 1678 Cross Keys Dr., N. E.

new facilities

Weldaloy Products Co. has opened a new facility at 1209 Chestnut St., in Burbank, Calif. to serve as headquarters for its Western Div. The division was established specifically to serve automotive, aircraft, appliance, and tube and pipe fabrication fields.

V V V

A new die assembly warehouse has been opened by The Producto Corp. in Cleveland, Ohio, at 13620 Enterprise Ave. Producto's catalog die sets, diemakers' accessories and toolroom equipment will be included in the new assembly operation. The warehouse also is able to give service on special die sets and other noncatalog items.

V V V

New structure for Dake Corp. will cost an estimated $500,000. It will include three 60-ft. bays designed to give ample clearance for moving materials with cranes. It will provide 45,000 sq ft of shop space and an office area of 5600 ft. The site for the building is south of Grand Haven, Mich.

Ace Drill Bushing Co., Inc., has opened a factory warehouse and sales office at 611 McCarter Hwy., Newark, N. J. The new concern will be called Ace Drill Bushing Co., Eastern Div., Inc.

V V V

A West Coast Div. has been opened by S & S Machinery Co. at 6945 Bandini Blvd., Los Angeles. This latest branch is a complete operating unit containing a showroom, service shop and completely stocked parts department.

V V V

Diversey Engineering Co. has announced construction of a new $250,000

plant at 10550 W. Anderson Place in Franklin Park, Ill. The facility will add 31,000 sq ft and incorporates the latest and most modern manufacturing facilities for production of guided missile, nuclear and jet hardware.

v v v

The Ohio Carbon Co. is now packing a proportioned selection of 128 replacement brushes which will service 803 different models of electric hand tools in order to provide user with an assortment that will prevent guesswork in selecting a brush to fit his tool.

v v v

A specialty steel warehouse has been opened at 8610 Page Blvd., St. Louis, by Crucible Steel Co. The event, which was celebrated by openhouse for area business men and industrialists, also marked observance of the company's 57th year of continuous steel warehousing service in the Midwest.

production notes

Stainless steel strip rolled to gages as thin as 0.0005 in. with thickness tolerances of ±0.0001 in. is now being mass produced at the plant of the American Silver Co.

v v v

The Formsprag Co. has licensed Renold Chains Ltd. of Manchester, England, to manufacture clutches under Formsprag patents for sale outside the United States.

v v v

A modern primary die stop has been added to the line made by Keystone Engineering and Manufacturing Co. The unit is designed to avoid lost time of die makers who formerly had to make a careful precision primary die stop installation and then harden the tip. The new stop is both easy to install and has a prehardened tip.

v v v

Hunter Tool has entered the miniature tool field with a complete set of miniature nut drivers which go down to the #00 hexagon nut. Approximate overall length of these drivers is 2½ in.

v v v

Progress toward production of titanium, zirconium and the Hastelloys in the form of clad steel plates is now resulting from current research at Lukens Steel Co. Potential applications of such clad steels are varied. Zirconium-clad for example may have numerous atomic applications; Hastelloy-clads would find uses in petrochemical processes; and titanium-clads may be applicable in acid processes and for services involving chlorides.

who's meeting and where

July 24-27. National Tool & Die Manufacturers Association. Summer meeting, Grove Park Inn, Asheville, N.C. Contact association office, 907 Public Square Bldg., Cleveland 13, Ohio, for details.

July 29-Aug. 2 and Aug. 5-9. Western Reserve University, School of Library Science in cooperation with Cleveland Public Library and Special Libraries Association. Special summer seminars designed for those interested in effective management of recorded information. Direct inquiries to Jesse H. Shera, dean, School of Library Science, Western Reserve University, 11161 East Blvd., Cleveland 6, Ohio.

Aug. 11-15. American Society of Mechanical Engineers. Heat transfer conference, Pennsylvania State University, University Park, Pa. For more data, contact society office, 29 W. 39th St., New York 18, N.Y.

Aug. 12-15. Society of Automotive Engineers. West coast meeting, Olympic Hotel, Seattle, Wash. Direct inquiries to Bruce E. Strasser, SAE public relations manager, 485 Lexington Ave., New York 17, N.Y.

Aug. 20-23. Western Electronic Show and Convention, Cow Palace Auditorium, San Francisco, Calif. For details write Donald E. Larson, Business manager, WESCON, 342 N. LaBrea Ave., Los Angeles, Calif.

Sept. 8-11. National Metal Trades Association. Eastern plant management conference, Essex-Sussex Hotel, Spring Lake, N.J. Write association headquarters, 337 W. Madison St., Chicago 6, Ill. for more information.

Sept. 8-13. American Chemical Society. Fall meeting, New York, N.Y. For further information, contact soci-

ety office, 1155 Sixteenth St., N.W., Washington, D.C.

Sept. 9-13. Instrument Society of America. 12th annual Instrument Automation conference and exhibit, Cleveland Auditorium, Cleveland, Ohio. Further information on exhibit is available from exhibit manager, Fred J. Tabery, 3443 S. Hill St., Los Angeles, Calif.; details of technical program may be had from Herbert S. Kindler, director of technical programs, ISA, 313 Sixth Ave., Pittsburgh, Pa.

Sept. 17-18. Radio-Electronics-Television Manufacturers Association. Symposium on numerical control systems for machine tools, Ambassador Hotel, Los Angeles, Calif. Obtain more facts from association headquarters, 11 W. 42nd St., New York 36, N.Y.

Sept. 17-20. American Die Casting Institute. Annual meeting, Edgewater Beach Hotel, Chicago, Ill. Institute office, 366 Madison Ave., New York 17, N.Y., can supply other facts.

Sept. 23-24. Steel Founders' Society of America. 55th fall meeting, The Homestead, Hot Springs, Va. Details are available from society office, 606 Terminal Tower, Cleveland 13, Ohio.

Sept. 22-24. American Machine Tool Distributors Association. Annual meeting, Hotel Cleveland, Cleveland, Ohio. Send inquiries to association office, 1900 Arch St., Philadelphia, Pa.

Sept. 23-25. Standards Engineers Society. Sixth annual meeting, Hotel Commodore, New York, N.Y. Request more information for society office, P. O. Box 281, Camden, N.J.

Sept. 23-26. Association of Iron & Steel Engineers. Annual convention, Penn Sheraton Hotel, Pittsburgh. More facts may be had from association office, 1010 Empire Bldg., Pittsburgh 22, Pa.

Sept. 24-25. Industrial Electronics Symposium, sponsored by Institute of Radio Engineers Professional Group of Industrial Electronics, American Institute of Electrical Engineers and the Chicago sections of IRE and AIEE. Morrison Hotel, Chicago. Send inquiries to E. A. Roberts (IRE) Union Thermoelectric Corp., 2001 Greenleaf St., Evanston, Ill., or H. L. Garbarino (AIEE), Armour Research Foundation of Illinois Institute of Technology, 10 W. 35th St., Chicago 16, Ill.

Sept. 29-Oct. 3. National Screw Machine Products Association. Fall meeting, Broadmoor Hotel, Colorado Springs, Colo. Write association office, 2860 E. 130th St., Cleveland 20, Ohio for details.

abstracts of FOREIGN LITERATURE

By M. Krumenberg
Consulting Engineer

Time Study of Fixture and Die Production

A book written by E. Mindt and published by Springer-Verlag West-Berlin on time study of fixture and die production (*Arbeitszeit Ermittlung im Werkzeugbau*), is the first of this kind. It covers times required for manufacturing of tools such as simple dies, progressive dies, tandem dies, perforating tools and others. The author discusses job planning, premium systems, incentive programs and the setting up of rate standards. More than half of the book deals with rate standard and time studies. Practical examples are taken from the author's shop.

The book is well written and detailed data is presented for many jobs which may well apply to any shop. Sixty-four tables are included. These are broad in coverage and may be used in many rate setting offices. Tables, such as "Time required for cylindrical grinding of shaft," may give an indication whether or not American practice is on the same level as that of the author's plant. The book will be useful to any tool engineer who can read some German. Assembly of dies is included.

Milling Research

Unit horsepower required for face milling is readily determined from a number of diagrams prepared by I. Bendixen. They cover carbon steel, molybdenum-steel and cast iron. The diagrams are based on the author's research in the machine tool laboratory of the University of Copenhagen, Denmark as well as research carried out in the United States. In his article, published in *Werkstatt und Betrieb* No. 5, 1957 Volume 90, pages 301 through 306, the author develops formulas for the relationship between the main cutting force, dimensions of the chip and true rake angle of the tool.

The author assigns a value of one to the main cutting force obtained when using a tool with a true rake angle of +5 deg. He shows that the cutting

force decreases in a straight-line relationship as the true rake increases.

The author also presents several curves on the relationship of cutting speed and cutting force ratio. These show that the cutting force decreases with increasing cutting speed for speeds up to 150 fpm but that it remains constant for higher speeds. The greatest drop in cutting force, however, occurs well below 150 fpm. All these relationships can be readily utilized for practical applications by means of the diagrams.

Another article, also dealing with power requirements in milling operations, is published in the same issue of *Werkstatt und Betrieb*, pages 296-298. The author is R. Weilenmann. He refers to Schlesinger's milling formula, which he found to be accurate within the limits for which it was intended. He presents similar formulas that have a wider field of application. They have the advantage of being derived from the same equation. Their application is primarily to face mills, but they also cover peripheral milling cutters and others, by minor adjustments.

Testing Surface Roughness

An article by H. Philipp, in *Werkstatt und Betrieb* 1957, No. 5, pages 227-280, claims that a number of European profilometers often do not cover sufficient length of the workpiece. In other cases it was possible to measure roughness but not waviness of the surfaces.

In cooperation with industry a speciel surface tester was developed in the laboratory of the Engineering College at Darmstadt which the author describes in the article. He presents formulas for the forces at the point of the tracer, which are used for calibrating the instrument. The pressure at the point is not constant in the new instrument and differs from standard profilometers also in the dimension of the tracer point itself. It has a radius of 0.0016 inch as against a radius of 0.000400 inch for the Leitz-Forster profilometer and a radius of 0.000020 inch of the Perth-O-Meter. Accuracy of the record is somewhat reduced, but it is claimed that the trouble often encountered when the point of the tracer cannot readily climb out of a deep valley is eliminated. It is also possible to use points with smaller radii.

Electromagnetic Drives for Machine Tools

While mechanically, hydraulically or pneumatically driven machine tools are well known, riveting machines driven by magnets are less familiar to the tool engineer. Such machines are finding an increasing market, particularly in the

watch and precision instrument industries of Switzerland. Several magnetically driven machine tools for riveting, pressing, punching and other metal forming operations are described in the Swiss magazine *Technica*, No. 3, February 1, 1957.

Their advantage lies in the elimination of gears, and of complex elements. The result is simple handling and low maintenance cost. Magnetic hammers can be equipped with automatic stroke control. The blow of the hammer can be accurately adapted to the requirements so that the workpieces, which are often fragile, are not distorted or destroyed. Workpieces which must run true, such as gears in watches, can be pressed on the shafts and riveted on the same machine.

There are machines with 3000 strokes per minute and others with only 60 strokes. The time varies between 0.2 to 6 seconds per stroke and can be adjusted in infinitely variable steps.

Blast Cleaning

A study has been made by E. Bickel on the testing of metallic blast cleaning materials. His results are published in No. 17, 1956 of *Stahl und Eisen*, pages 1116 through 1128. Stating that the American standards for screens, and the granular size of these materials, are not satisfactory the author suggests methods and standards authorized by a special committee of the Association of German Mining Engineers. He comments on the fact that the number of meshes in the screen has been taken as a measure for the grain size, which is the reciprocal of the desired quantity.

He thoroughly discusses the significance and applications of blast cleaning and the testing of quality and efficiency of the material. This is subdivided into four main categories; namely, shot, gravel, wire scrap and chips. Testing includes chemical and metallographical tests, determination of hardness, impact strength and other quantities. Several wear testing machines are described and also a dial indicator for testing peening effect. Standards are also suggested.

Machining of Fine Threads

A booklet authored by C. H. Stau and published by *Deutscher Fachzeitschriften* und *Fachbuch Verlag*, Stuttgart, Western Germany, deals with turning and milling of precision threads, such as used for lead screws on machine tools. The author goes into the geometrical relationships involved and discusses two basic manufacturing methods: turning and milling. Shaving of lead screws is also covered. German standards for toolroom lathes are included. Price is about $1.

2 Firth Sterling MECHANICAL TOOLHOLDERS

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With these two Firthite Mechanical Toolholders and Firthite Carbide throw away Inserts you can handle almost any turning, facing and chamfering operation at lower tool cost and with less downtime for tool maintenance and resetting. *Mechanidex* for heavy duty, high production jobs; *Thriftool* for lighter ones. Use these two and save time and money!

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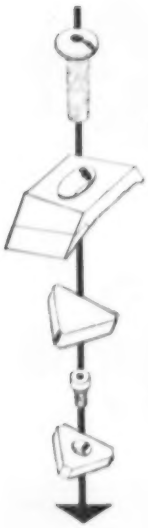

- Mechanidex toolholders feature one-piece adjustable chipbreaker clamp, eliminating loose parts when indexing.
- Carbide tipped or high speed steel chip-breaker clamps optional.
- Clamp screw nut eliminates heat-seized clamp screws, permitting easier insert indexing and replacement.
- Available in 4 styles Right or Left hand in shank sizes ranging from ¾" sq. to 1¼" sq. (Can use complete line of standard throw away inserts.)
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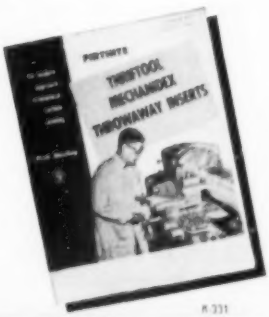
- Triangular throw away inserts with 6 cutting edges . . . no grinding, use each cutting edge once then throw away.
- Outlasts single point brazed tools.
- Lowest cost mechanical toolholder; fewest component parts. (Chipbreakers optional.)
- Toolholder parts interchangeable — reduces inventory and handling costs.
- Precision anvil assures proper insert positioning. (¾" square shanks and above.)



Write to:

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Men at Work

R. E. Cornwell is new president of Union Carbide Development Co., Div. of Union Carbide Corp. Mr. Cornwell, who started with Union Carbide in 1923, has held key engineering positions with Linde Co. and Union Carbide Chemicals Co., both divisions of the corporation. In 1942 he became vice-president of Linde and in 1956 vice-president of the newly formed Union Carbide Development Co.

At its 41st annual meeting, American Gear Manufacturers Association elected **LeRoy R. Brooks** to serve as its president for the coming year. Mr. Brooks is president of Tool Steel Gear & Pinion Co. Other elected officers were **E. F. Borisch,** executive vice-president of Milwaukee Gear Co., who was made vice-president of the association, and **John L. Buehler,** president of Indiana Gear Works, Inc., who was named treasurer. Mr. Buehler also is a member of ASTE's Indianapolis chapter.

Three vice-presidents elected by the board of Woodruff and Edwards Inc. involved **Orval Graening** who became vice-president of the Foundry Div., **Harold F. Lewis,** who now is vice-president-general sales manager, and **Carl O. Tolf Jr.** who was elected vice-president, Wade Div.

Howard Dingle (left) and George H. Acker (right) have been elected chairman of the board and president respectively of both The Cleveland Worm & Gear Co. and its affiliate, The Farval Corp. Mr. Dingle previously was president while Mr. Acker held the post of executive vice-president.

Two recent appointments at Wheelabrator Corp. involved **Verne E. Minich,** founder of the company, who was made honorary chairman of the board, and Otto A. Pfaff who was elected chairman of the board. Mr. Pfaff continues to serve as president of the firm.

Super Tool Div. of Van Norman Industries, Inc. has revealed appointment of **L. B. Szal** to the office of vice-president, production, and of **Milton J. Steffes** to vice-president, sales and engineering. Mr. Szal, former production manager, will be in charge of production at the division's three plants in Detroit and Elk Rapids, Mich., and Los Angeles. Mr. Steffes was general manager of sales and engineering.

American Society of Lubrication Engineers has elected **J. O. McLean** of Reynolds Metals Co. as president for the 1957-58 year. New vice-president-at large is **J. D. Lykins** of Wheeling Steel Corp.

Hermann K. Intemann is now president of Electro Metallurgical Co., Div. of Union Carbide Corp. Associated with Union Carbide since 1930, he has been executive vice-president of Electro Metallurgical Co. for the past year.

The Ohio Crankshaft Co. has announced appointment of **John F. Cachat** as works manager of its Tocco Div. to head engineering and manufacturing activities. He previously was Cleveland district manager.

Alfred J. Sherman is now vice-president in charge of manufacturing for The Monarch Machine Tool Co. Associated with Monarch since 1916, he has been general superintendent for the past 10 years.

Baboo Ram Teree was made vice-president in charge of engineering and manufacturing of Greer Hydraulics, Inc. He formerly was chief engineer and manager of engineering and manufacturing.

George A. Roberts, vice-president of technology for Vanadium-Alloys Steel Co., was elected board chairman and president of Metal Powder Assn. Dr. Roberts also belongs to ASTE's Pittsburgh chapter.

S. C. Amren has been named vice-president of manufacturing for Charles Bruning Co., Inc. Prior to joining Bruning, he served as vice-president and general manager of the A. M. F. Cycle Company.

Henry S. Harrison was made plant superintendent for the machine and tools division of Michigan Tool Co. and will supervise manufacturing operations of the company's Six Mile Rd. plant. For the past year he has been plant superintendent for the company's new Gear-O-Mation Div., a position now held by **Al Combs.**

New chief engineer of J & S Tool Co., Inc. is **Preston D. Liebig.** Previously he has held engineering and production control positions with Curtiss-Wright, General Electric and Douglas Engineering.

Gardner-Denver Co. recently announced election of three new vice presidents. The three include **George W. Gutekunst,** who continues in his former capacity of general sales manager; **C. H. Rieman,** who also remains general manager of the company's Denver plant; and **Brice D. Maddox,** who also is general manager of the Keller Tool Div.

Promotion of **Hayward A. Gay** and **Philip O. Geier, Jr.** has been announced by The Cincinnati Milling Machine Co. Mr. Gay, a vice-president of the company, has managed the Products Div. since its establishment in 1944. He now is manager of the Machine Tool Div. Mr. Geier, who was assistant manager of the Products Div., now is manager of that division.

Promotion of **Edward J. Ferris Jr.** to factory manager of the Machinery Div. has been announced by Pratt & Whitney Co. Inc. General superintendent of Pratt & Whitney since 1955, he has been associated with the firm since 1922.

Sheffield has changed or added management responsibilities for five of its executives. **O. A. Ahlers,** senior vice-president, now also is given overall direction of the Machine Tool, Contract Manufacturing and Threadwell-Conway Tap and Die Product divisions. **W. Fay Aller,** previously vice-president of the Autometrology Div., was made vice-president to supervise and coordinate the Autometrology, Standard Production Instruments, and Fixed Gage and Inspection Instruments Divs. **J. T. Welch,** who was general manager of the Machine Tool Div., was named assistant vice-president for coordinating operations of the national field sales organizations. Mr. Welch is a member of ASTE's Dayton chapter. **C. H. Reynolds,** senior vice-president, now also will have charge of the company's manufacturing facilities in Mount Clemens, Mich., Cleveland and Windsor, Ontario. **William I. Wilt,** former general manager of the Standard Production Instrument Div., was advanced to assistant vice-president of that division.

Trade Literature

for free booklets and catalogs—use convenient request card, page 169

Welding

Three brochures dealing with the semiautomatic Unionarc welding process include: Bulletin F-1060, "A Better Way to Weld Steel," presents results of production line tests on the process; Bulletin F-1076, "New Continuous-Feed Arc Welding," deals with development and appilcation of the process; Booklet F-1066, "'Unionarc' Welding Process," incorporates a technical article describing welding quality obtained. Linde Co., Div. of Union Carbide Corp., 30 E. 42nd St., New York 17, N. Y. **L-7-1**

Taps

Designed to make tap selection and application easy, this tap catalog has three sections; first section incorporates an easy-to-use table for selection with complete information on class of fit, limit numbers and gage data, and availability from stock; second section covers special taps carried in stock ready for shipment; third section provides tap-drill and thread-engagement selection tables for all common materials. Besly-Welles Corp., South Beloit, Ill. **L-7-2**

Screw Machine Tools

Illustrated 8-page Bulletin S 25 covers tools for the Brown & Sharpe No. 2 automatic screw machine to permit users to take full advantage of the equipment's full possibilities. Brown & Sharpe Mfg. Co., Providence, R. I. **L-7-3**

Gages

Go and Not Go electric limit contact gages utilizing light signals are described in illustrated March edition of "Precise Production"; discusses special features, various applications and advantages of these gages. George Scherr Co., Inc., 200 Lafayette St., New York 12, N. Y. **L-7-4**

Worm Gear Drives

Bulletin 145, "Finger Tip Facts on Cleveland Worm Gear Drives", presents in 16 illustrated pages useful summary information on complete standard line of speed reducers, worm gear sets and special units. The Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland 4, Ohio. **L-7-5**

Air, Hydraulic Equipment

Revised edition of "The Facts of Life on Air and Hydraulic Devices" presents concise outline of how to proceed in installing hydraulic and pneumatic systems and gives do's and don'ts for making an installation; also suggests what to look for if the system fails to function properly. Logansport Machine Co., Inc., Logansport, Ind. **L-7-6**

Filters

Sixteen-page Bulletin 7C provides information on design, construction, specifications and capacities of standard, high pressure and duplex models of laminated fiber disk filters; includes discussions of special purpose assemblies, accessories and provides installation data. Wm. W. Nugent & Co., Inc., 3440 Cleveland St., Skokie, Ill. **L-7-7**

Carbide Tools

Illustrated 12-page brochure contains information on Golden Circle line of carbide rotary tools, with emphasis on electro-ground end mills manufactured by the electrolytic process; includes operating suggestions covering end mill, reamer drill and bur speeds as well as data on recommended feeds when working with most metals, hard rubber and plastics. Abrasives Div., Elgin National Watch Co., Elgin, Ill. **L-7-8**

Belt Drives

Extensively illustrated 112-page Engineering Data Book No. 10 deals with selection and design of Poly-V belt drives, includes useful charts, tables and diagrams plus complete specifications for all drive sizes. Comprehensive data on V-belt drives includes drive tables, horsepower ratings, installation instructions and trouble shooting. Manhattan Rubber Div., Raybestos-Manhattan, Inc., Passaic, N. J. **L-7-9**

Lubrication

Illustrated 8-page Bulletin #70 describes recently developed type of circulating oil system called Lubrival for application on presses and semiautomatic or automatic machine tools etc. with built-in return oil arrangement; emphasizes important features of system including its self monitoring ability for warning of clogged or broken lines. The Farval Corp., 3249 E. 80th St., Cleveland 4, Ohio. **L-7-10**

Single Point Tools

Three separate lines of single point lathe tools presented in Catalog #571; two sections cover single point tooling that utilize throw-away inserts, the third section describes extra heavy duty regrindable insert tools. Emphasizes features and advantages of this tooling which is usable with carbides, high-speed steels, oxides and ceramics. Well illustrated by drawings. The Viking Tool Co., Inc., 1000 Nichols Rd., P. O. Box 471, Shelton, Conn. **L-7-11**

Powder Metal

Catalog No. 57 on powder metal part fabrication covers self lubricating oil impregnated bronze and iron bearings of standard sizes for immediate shipment; also furnishes technical data to help user in selection and installation of such bearings. Second brochure, "Evolution of Powdered Metal," provides general coverage of average products of powder metal; also discusses the facilities of Asco and showing their completeness and self sufficiency. Asco Sintering Corp., 7799 Telegraph Rd., Los Angeles 22, Calif. **L-7-12**

Positioning Control

Functions of numerical positioning control described in 14-page Bulletin GET-2675; gives breakdown of three major elements, lists features and graphically illustrates each operation. General Electric Co., Schenectady 5, N. Y. **L-7-13**

Cemented Diamonds for Grinding

Six-page progress report, Bulletin #LO-5709, on permanent form control of grinding wheels using cutters of cemented diamond particles contains schematic drawings to illustrate principle involved, photos of cutters, illustrations of actual installations on Jones & Lamson grinders and others details. Koebel Diamond Tool Co., 9456 Grinnell, Detroit 13, Mich. **L-7-14**

Speed Reducer

Details on improved and extensive line of speed reducers, incorporating double-enveloping worm gearing for greater load carrying capacity, presented in 24-page Bulletin CD-218; contains specifications for both standard extended shaft and shaft mounted models, dimensioned assembly drawings and complete tables of pertinent data. Cone-Drive Gears Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. **L-7-15**

Plastic Sheet

Information on handling, machining, forming, cementing and annealing of Cadco extruded acrylic plastic sheets offered in 12 page brochure; tables show properties; charts give light transmittance and include comparison with cast sheet. Cadillac Plastic & Chemical Co., 15111 Second, Detroit 3, Mich. **L-7-16**

Soldering and Brazing

Illustrated folder explains controlled soldering and brazing by induction heating stressing advantages of technique and company's facilities and ability to provide solutions to problems in this field. McDowell Electronics, Inc., 117 Woodside Ave., Metuchen, N. J. **L-7-17**

End Mills for Aluminum

Complete line of standard end mills for milling aluminum, including 2, 3, 4 and 6 flute designs, square and ball nose types, shell end mills and standard and Postiv-Lok shanks in lengths from 2½ to 11⅝ in. and diameters from ¼ to 6 in., presented in Catalog 457. Putnam Tool Co., 2981 Charlevoix Ave., Detroit 7, Mich. **L-7-18**

Surface Hardening

How Electrolizing increases life and improves performance of metal wear parts is described and documented in 24-page booklet which explains what the process is and the details of its usefulness; also reports results of various tests and comparisons. The Electrolizing Corp., 1505 East End Ave., Chicago Heights, Ill. **L-7-19**

Aluminum Brazing

Bulletin 23 describes Alumibraze, an alloy for joining aluminum parts; gives step-by-step details on dip brazing with this powdered aluminum-silicon alloy; describes design techniques, fixturing arrangements and salt-bath requirements. Handy & Harman, 82 Fulton St., New York 38, N. Y. **L-7-20**

Filters

Six major filter types for industrial applications discussed in 8-page illustrated brochure; complete descriptions of filter operations are given as well as applications, degree of filtration and flow rate capacities. Industrial Filtration Co., Dept., GB-298, Lebanon, Ind. **L-7-21**

Small Parts Components

Complete kit calculated to acquaint product designers and production men with possibilities for cost reduction in small parts components through tiny precision die castings and thermoplastic moldings; shows how machining and assembly methods can be reduced, and discusses other methods of product improvement; charts compare techniques for automatic die casting and molding for design flexibility, production speed, tooling charges, scrap loss, degree of uniformity, tolerances, physical properties, etc. Request only on company letterhead direct to Gries Reproducer Corp., 400 Beechwood Ave., New Rochelle, N. Y.

Drills

Catalog contains all details on complete line of drills as well as end mills, reamers, tool bits and other related tools; illustrated index facilitates use; tables provide pertinent information on high-speed, carbide tipped and solid carbide tools; includes information on automotive and aircraft drills. Besly-Wells Corp., South Beloit, Ill. **L-7-22**

Pumps

Catalog data folder No. 343 incorporates selector chart, offers aid to users of fluid handling equipment in selection of pump model best suited to specific needs; includes information on heads, capacities and other useful data. Barnes Mfg. Co., Mansfield, Ohio. **L-7-23**

Clad Metal

Technical data Bulletin No. CM-901 is designed to provide an easy-to-use and reliable reference source for application and purchase of clad metals; topics include cost savings, man and material savings, types of clad metals, specific applications; a Clad Metal Finder chart shows major types of clad metals available, their design and engineering functions and their applications. American Silver Co., 36-07 Prince St., Flushing 54, N. Y.

Stud Welding

Tips on how to make use of the advantages of stud welding included in 24-page design manual on the subject; describes physical properties of various stud types; special section discusses stud selection, counterbore and countersink dimensions for accommodating weld fillets, recommended thicknesses of steel on which studs are welded, and stud locating procedures including template design. Nelson Stud Welding Div., of Gregory Industries, Inc., Lorain, Ohio. **L-7-24**

technical Shorts

Use Dynamite For Forming

EXPLOSIVE forming methods are being developed in the aircraft industries to produce absolutely smooth shapes. Through this means of forming, even complex contours in hard and difficult-to-form metals can be created without riveted attachments. Research currently under way at Lockheed is making use of explosives ranging from a .22 caliber rifle cartridge to 8-ga shotgun shells. Engineers involved in the program anticipate that these explosives may be prime factors in solving manufacturing problems of hypersonic aircraft.

★ ★ ★

Film Deals With Machining Steel

HOW ENGINEERS and metallurgists develop free-machining steels that can be worked at high rates of production is shown in a 30-minute 16-mm film, "Machining Stainless Steels," released by Armco Steel Corp. The film, which deals solely with the subject of machining stainless steels, also demonstrates tool composition and proper use for different kinds of tools. It also outlines tool grinding principles and shows proper setups that assure rigidity and prevent vibration and shock to tools.

Prints of this sound motion picture are available through the distributor, The Jam Handy Organization, 2821 E. Grand Blvd., Detroit, Mich.

★ ★ ★

Interchangeable Joints for Lab Glassware

A SYSTEM of joining laboratory glassware by means of interchangeable joints has been developed by the British firm of chemical and scientific glass blowers, W. G. Flaig & Sons, Ltd. The company, which is applying for United States patent for the product, describes the joints as foolproof, trouble-free and economical. The joints, called Flexicons, offer advantages found in both spherical and conical joints while also providing flexibility. They require no mechanical means to hold them together.

Precise fit of the unground joints is achieved by compression of flexible rings between the cone and socket. The glass socket has a normal 1:10 taper, and the cone is a specially designed glass molding fitted with two heat and chemically resistant flexible rings with a 1:10 taper. When the cone and socket are fitted together, the seal is made by the ring at the narrow end—the second ring acts as a stabilizer.

The rings are made of silicon rubber which retains its resilience and physical properties at very high temperatures and is resistant to most chemicals. Complete chemical resistance can be achieved with a fluon barrier with a working temperature of from −100 to + 300 C which is fitted between the ring and the flange at the narrow end.

good READING

FACTORY ELECTRIFICATION — *by F. T. Bartho and C. H. Pike. Published by Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. Price $12. 408 pages.*

When designing a factory layout, one of the first and most important considerations is that of the electrical power supply for the immediate and future manufacturing requirements. This book provides a general guide to the selection and use of electrical equipment for factories, treating the subject in an essentially practical manner.

It is easily understood by all who are familiar with the elements of the theory and practice of electrical engineering, and dealing with the general requirements in installation, distribution, cable and wiring systems.

The various types of a-c and d-c motors with their control gears are fully covered and there is also a chapter on motor application.

ENGINEERING ENROLLMENT IN THE UNITED STATES—*by Norman N. Barish. Published by the New York University Press, Washington Square, New York 3, N. Y. Price $7.50. 238 pages.*

A study of the reasons why a severe shortage of scientists and engineers exists in the United States and of the way we can best combat this crisis, is the major theme of the book.

Specialists in the various branches of engineering survey the whole field of engineering education in this country in an attempt to give as clear a picture as possible of the nature and magnitude of our engineering manpower problems. They present basic statistics on enrollment trends in engineering schools and suggest some possible interpretations of these trends. They help answer the questions that industry, education and government are confronted with in their search for a vigorous new plan to supply enough technical brainpower.

A chapter on engineering education in the USSR has also been included to place the growth of our engineering educational program in clearer perspective.

One of the author's principal conclusions in this study is that the current shortage of engineering talent is critical with respect to engineers with a high degree of mathematical and scientific orientation and those with unusual analytic and design creativity. Rather than plan merely for an increase in the total supply of engineers, we should focus our attention on meeting these qualitative needs. A new pattern for engineering education to meet these needs is proposed.

MANUFACTURING ORGANIZATION AND MANAGEMENT—*by Harold T. Amrine, John A. Ritchey and Oliver S. Hulley. Published by Prentice-Hall, Inc., 70 5th Ave., New York 11, N. Y. Price $6.75. 462 pages.*

The purpose of this book is to acquaint the person inexperienced in the field of management with the principles and functions of manufacturing management. Because the material is presented in a nontechnical manner, it is suitable for both engineers and non-engineers.

Dealing with many of the activities and interrelationships that are encountered in managing, the book contains a condensed version of the principles of manufacturing management, as well as the philosophy and practices of management.

Maximum emphasis is placed on those functions that are usually controlled by the manager of manufacturing. However, the areas of marketing, financing and personnel are included, to show the interrelationship between these areas and the over-all management problem.

METALLURGY-4TH EDITION—*by Carl G. Johnson and Wm. R. Weeks. Published by American Technical Society, 848 E. 58th St., Chicago 37, Ill. Price $5.50. 464 pages.*

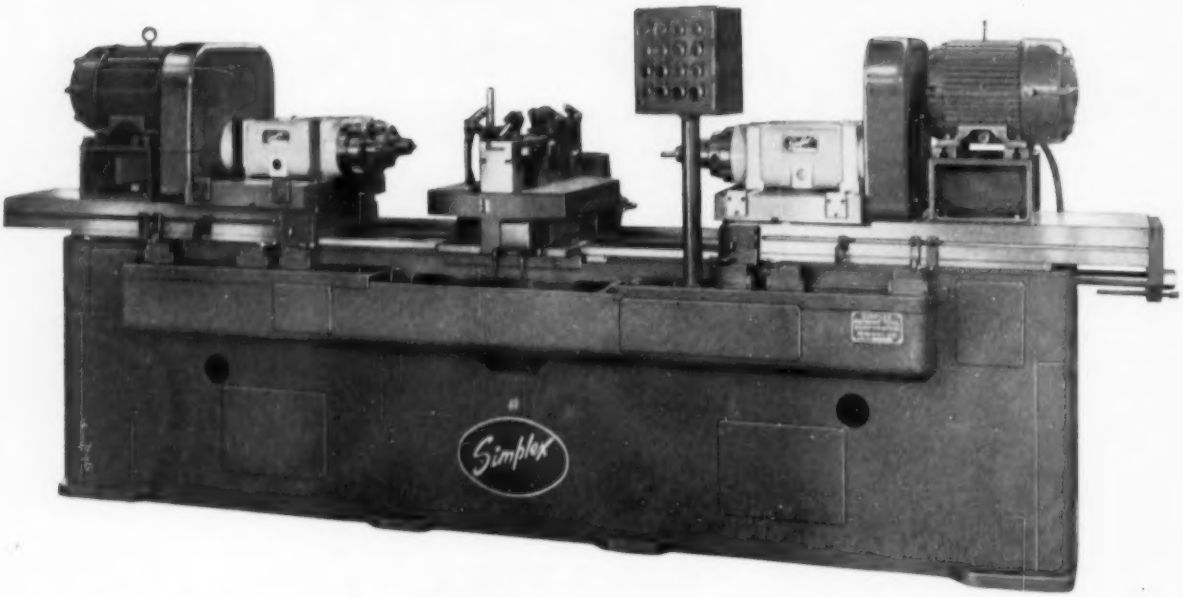
This practical survey work is concerned primarily with physical metallurgy—dealing with the physical and chemical behavior of metals during shaping and treating operations, and their behavior in the service of man. The selection and application of metals is discussed at length throughout the book.

This fourth edition includes a new chapter on titanium, zirconium, indium and vanadium, methods of production, physical and mechanical properties, and uses of these important new additions to the family of engineering metals.

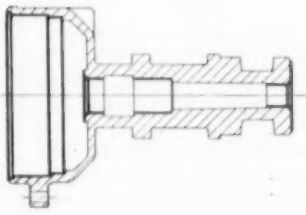
Quiz questions are included after each chapter. These questions were carefully chosen to require not only the recall of factual knowledge, but also to test the ability of the reader to apply that knowledge.

Simplex

PRECISION BORING MACHINES



SIMPLEX 2U 2-Way Hydraulic Feed Precision Boring Machine equipped with four #3 SIMPLEX self-contained and automatically lubricated precision boring heads for finishing a distributor base. The fixture is a two-station hydraulically indexed platen type rotary table with four manually clamped work holding fixtures. Operations performed are indicated by the heavy lines on the piece part.



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designing for automation

Tech Digests

By Kurt O. Teeh
Vice President, Engineering
The Cross Co.
Detroit, Mich.

ANALYSIS OF MANUFACTURING industries shows that rapid progress has come through mechanization of material handling between machining, cleaning, gaging and assembly operations. Analysis of costs for moving parts around a manufacturing plant shows that a fertile field exists in this area for reduction of over-all production expenses. It was recently estimated in a large electrical manufacturing concern that material handling is responsible for about 25 percent of the total cost of the product and almost 40 percent of the total labor cost.

The primary contribution of automation has been in integrating machining and assembly operations with material handling to provide automatic processing. Progress in this field is limited by experience, technology and the design of the product being processed.

Product designers generally are well aware of the effects which the design of a component can have on the cost because of the machining operations required. They know that surfaces which must be contour machined, rather than machined as planes, increase the cost. They are aware of the fact that angular holes, whether drilled, tapped or bored, are more expensive than horizontal or vertical holes. The fact that the greater number of different angles of holes which exist on a part increase the number of machining stations and the cost of capital equipment is also well known. Closer tolerances mean higher cost to most designers. Experience with product designers indicate that they are coming more and more to appreciate the need for proper locating and clamping points because it assures a much better chance of having the part machined to drawing specifications.

Not nearly as well known or understood is the effect which the design of a part can have on costs through the handling, storing and assembling of such parts. Many times insufficient consideration given to these problems in product design results in excessive costs in their manufacture. In the future such thinking will also have to be applied to the lower production industries.

In the machining of parts in automation type of machine tools it is necessary that provisions be included on the part; either as a part of its functional design or as an addition, to permit its being carried through a series of machining operations easily. This normally involves means of guiding and supporting the part between operations and means for locating it accurately during successive machining operations.

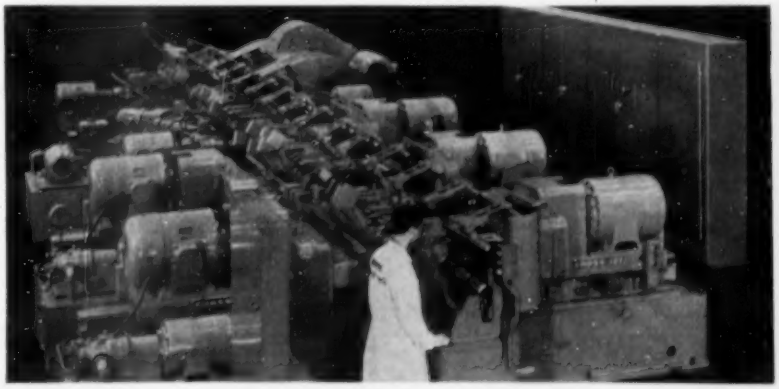
If they are not provided on the part, and at times they are impossible to provide, it then becomes necessary to locate and clamp the part on a pallet. This adds considerably to the capital cost because the pallets and the pallet return mechanism are additional equipment, which would not be required if the part could be guided through the machine by itself and located and clamped in each station.

Design for easier handling often presents the product designer real difficulties, but many times slight differences in design can mean large differences in outlay for the capital equipment necessary to machine the parts.

As an illustration of this is found in crankshaft bearing cap assemblies. Each of these assemblies carries all of the bearing caps for one engine in one casting. It is normal practice to do all of the machining operations with the caps connected, then saw them into five separate pieces as a final operation. These bearing cap assemblies are slid between machining stations on guide rails as is shown in *Fig.* 1, next page.

This figure illustrates the bearing cap assembly-*A* which is basically a square block of cast iron with a single protrusion along the center of one side of the four intermediate caps. This protrusion contacts one of the three guide rails and permits easy handling.

Bearing cap assembly-*B* has a large circular head on the main bearing cap. Because of this it was impossible when designing a machine to provide a simple guide. The result was a more



Transfer machine for automatically machining cylinder cap assemblies.

THIRTEEN STATION AUTOMATIC TRANSFER MACHINE

— mills, drills, reams, spotfaces, taps and saws apart cast iron bearing cap blocks. Machine includes 5 standard feed slides, 9 standard production units.

Because major components are standardized

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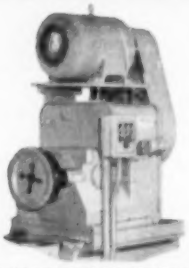
STANDARD ROTARY INDEX TABLE available in 4 different table diameters, any practical number of indexes.



STANDARD MILLING HEAD UNIT 4 sizes. Single spindle . . . various horsepower and speed ranges . . . single or double reduction drive . . . automatic quill retraction. Any size can be modified for boring.

Here's a sound, proven *economical* approach to your production machine tool problems . . . Kearney & Trecker production machine tools featuring standardized components.

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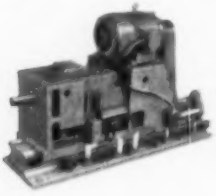
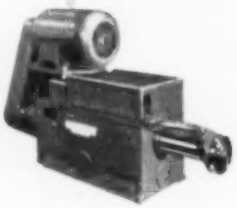
STANDARD FEED SLIDE UNIT provides hydraulic feed for milling, boring or drilling heads. Available in 4 sizes and in various length cylinder strokes.



STANDARD WAY TYPE DRILL UNIT for drilling, boring, reaming, counter-boring and chamfering. Single and multiple spindle arrangements, single or double feed rates.

ASK FOR FREE KEARNEY & TRECKER Production Machine Tools Bulletin SMD-57. It provides full standard component details — and their application to production machine tools.



STANDARD QUILL FEED UNIT for drilling, boring, reaming, spotfacing, counter-boring and chamfering. Single or multiple spindle arrangements — single or double feed rates.

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Designers and Builders of Precision and Production Machine Tools Since 1898

complex transfer mechanism, involving a motion transverse to the direction of transfer, to support the part during its transfer. Since it was more complex it has been a more troublesome mechanism to maintain in the field.

The cost of the equipment to manufacture 110 B-bearing caps per hour was 45 percent greater than the cost of the equipment to manufacture 180 A-bearing caps per hour. Much of this additional cost can be attributed to the design.

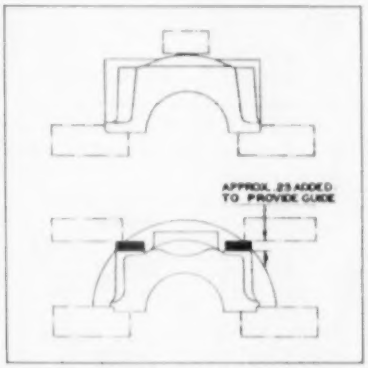


Fig. 1. Means for guiding bearing cap assembly-A through transfer machine (top); compared with guiding means for bearing cap assembly-B, (below).

If thought had been given to this guiding problem by the product designers the bearing cap stud bosses on the intermediate bearing caps could have been raised 0.25 inch.

This change would have made possible a simpler form of guiding and would have reduced the initial price of the machine and the maintenance costs.

Automatic Assembly Needs

Automatic assembly is becoming more common. Here too, design of the various components to be assembled can have a tremendous affect on the cost of the equipment required and in many instances in determining whether or not the parts can be assembled automatically.

Some of the requirements of product design to help simplify automatic assembly are:

1. The basic part must have proper guiding surfaces accurate enough so that the part can be moved through the assembly machine without the use of complex transfer mechanisms.
2. The part must have accurate locating holes or surfaces so that it can be positioned properly in the various assembly stations.
3. If any of the parts must be positioned a certain way for assembly, external means to indicate from should be provided on the part for proper orientation.
4. Configuration of the various pieces assembled to the basic part should be such that they can be guided to the proper place for assembly without resorting to an overly complex distribution mechanism.
5. Part tolerances on these components must be held to permit the proper positioning relative to the major assembly. Sometimes it is necessary to hold part tolerances closer for automatic assembly purposes than is necessary in their final function in the product.

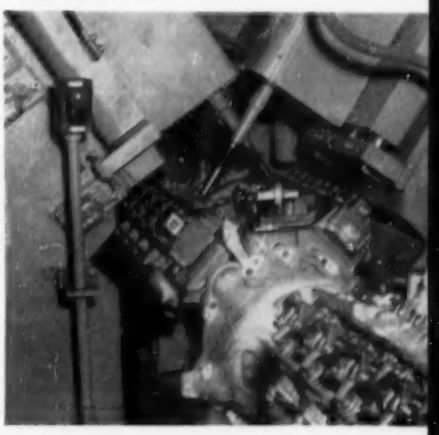
In addition to these factors there are others which can have an affect.

Just as in the case of machining a product, design which allows for easy assembly may be difficult to obtain, but in many instances also, relatively simple changes may make the difference between a manual assembly operation and an automatic assembly operation.

An example of a relatively minor design change, which would tend to eliminate most of the problems involved in its automatic assembly, is the valve lock used in holding an exhaust or intake valve assembly together in an internal combustion engine. This is a perfectly acceptable design from a functional point of view.

In the machine which assembles the various valve components to a cylinder head, one of the operations channels this valve lock into a position adjacent to the valve stem, with the spring and washer compressed. The easiest way of doing this is by orienting the parts as they come from a hopper so that the small end will lead and deliver them in this proper orientation through chutes to a position around the valve stem, while the spring is compressed.

Automatic assembly setup for assembling valve locks.



The spring is then released, while holding the valve lock in position, until it engages with the retaining washer.

It is difficult to guide a series of these locks through a chute without jamming them, because the two outside edges are not parallel, Fig. 2. Only a point contact exists on the upper end of the valve lock as it goes through the chute. The key on the inside of the valve lock also provides short guide which permits cocking of the valve lock in the chute and subsequent jam-ups.

Continual jamming problems occur to a great extent because of design

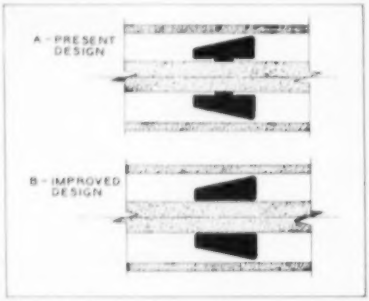


Fig. 2. Means for guiding valve lock in distribution system of assembly machine before and after design change.

defects. By making a slight change to this valve lock, illustrated in Fig. 3, the design functionally would be just as good as the previous design and would be infinitely better for automatic assembly. Using the full length of the valve lock for guiding would eliminate 95 percent of the jamming problems.

There are three strong influences on the design of any product. First, the engineering or functional design of the product. Second, the appearance or styling of the product. Third, the manufacturing of the product.

Usually the manufacturing influence —taking into consideration the latest methods in manufacturing practice— has the least influence. This has come about because of the difficulty of mechanical design engineers to be completely familiar with all of the possible variation in manufacturing practice.

The solution to a well balanced design will involve a three man team: the design engineer, the industrial designer and the manufacturing engineer. It will be necessary for the manufacturing engineer to participate at the inception of the product design in order to do the most good. Decisions of the type which must be made involve a full consideration of the manufacturing objective.

From a paper "Designing for Easier Machining, Handling, and Assembly" given at the 1957 Design Engineering Conference, sponsored by The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

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How to Get the Most Out of Springs

By John Beckwith
Product Engineer
Associated Spring Corp.
Bristol, Conn.

Springs are a vital member of most mechanisms. They are often in the "safety of flight" category in the aircraft field. Their importance in the over-all cost and function of a mechanism completely overshadows their relatively small expense. Many designers have found out the hard way that a little spring is often the make-or-break of the finished equipment. This success or failure goes back to the original design or absence thereof.

A spring designer is a fence walker. He is in trouble no matter which way he leans. The finished spring can be over or under designed and he is in trouble either way.

The underdesigned spring breaks or sets. This is soon emphatically apparent. More troublesome is the spring that doesn't quite succeed—a prototype that appears successful and production that fails because of the normal scatter of fatigue results. It is easy to make an overstressed spring. There are strong temptations and pressures to design them.

Even more surprising is the number of springs that are not designed. These are born of cut-and-try methods. For instance a machinist may make springs or rework existing ones to do the job. In these the design will not be checked, let alone engineered, until there is a field failure or a cost and engineering review.

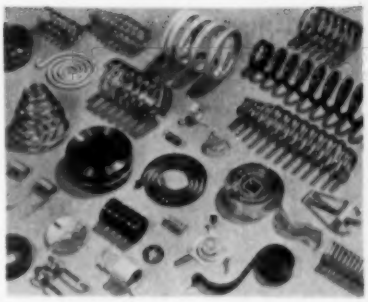
The three factors of cost, weight and space are important in design. Some of the factors that must be considered are: stress vs. cost, weight vs. stress, and space vs. stress. The spring designer must have the experience to walk the fence without falling into inefficiency of low stresses or falling into the morass of unreliability and fatigue failure.

Design limits in the pursuit of higher safe stresses, are partly controlled by materials. Progress is continually made in that field.

Considerable work is now being done in the fields of elevated temperature. Limitations of space as well as increased operating speeds in mechanisms are creating temperature problems. During the past five years production limits in the spring field have moved up to 1000 F.

The usual carbon steels are reliable up to 300 F. And the range above their chrome-vanadium and chrome-silicon take over. At 500 F. stainless steels are found. Inconel is good at moderate stress to around 600 F. From there to 1000 F. are the nickel and cobalt alloys such as Inconel X, S816, etc.

The most common forms are compression, extension, and torsion springs. There is more technical information available on these than any other forms. Calculations are straightforward. There are various tables, nomographs and



Examples of various spring styles and shapes available as standard items.

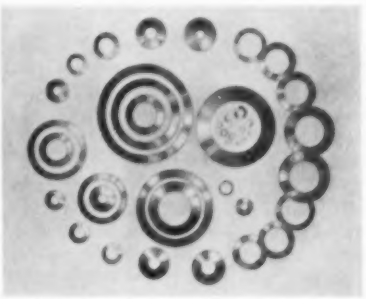
data available to aid the designer. Relatively small changes in the design, however, will affect the cost of a spring. The original work by the designer is most important in insuring the presence of sufficient room for the spring.

Somewhat less familiar are spring forms such as flat springs, flat coil or clock springs, spring washers. These might be used to advantage by designers but frequently are overlooked or shunned because there is not as much information available.

Flat springs are particularly valuable because with them it is often possible to achieve two or more functions. In high-volume production this may result in major savings. Such a case is that of a spring in the commutator section of a power rheostat.

In this, a single flat spring (1) holds a carbon brush, (2) applies a spring pressure on the wire windings of the rheostat, (3) provides spring friction detent action, and (4) acts as a spring retainer on the rotating shaft. In this instance the single spring replaced six separate pieces in the original design.

Spring washers are finding much usage in the machine tool industry. Wavy washers are commonly used to axially preload bearings. These washers can be used to absorb manufacturing tolerance build-ups in component parts. This function of tolerance eating is the star function of the spring washers known as the Belleville. This is probably the simplest appearing yet trickiest spring form.



Belleville springs in various sizes and widths show range of applications.

The Belleville washer inherently delivers a heavy load with a relatively small deflection. An example of the advantage of use of Belleville washers is on the live spindle. The workpiece can be loaded on a lathe and as the piece heats up and expands the Belleville washers absorb the change in length without adding any appreciable load to the machine.

Mechanical springs are basically a means of storing energy. The maximum amount of energy available is dependent upon the amount of material available. Metallurgy can change it somewhat. Also some spring forms fit more efficiently into a particular available space. It is possible to obtain approximately 500 inch pounds of work from one pound of active spring steel.

From a paper given at the 1957 Machine Design Conference, Cleveland Engineering Society, Cleveland, Ohio.

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Why Nondestructive Testing

By Richard F. Holste
Director of Engineering
X-Ray Products Corp.
Rivera, Calif.
and
Harvey W. Hill
Quality Control
Douglas Aircraft Co.
Santa Monica, Calif.

Nondestructive methods constitute one of the great single factors contributing to increased safety in transportation and military airflight. Indus-

try rapidly is realizing that judicious nondestructive testing of materials and assemblies are aiding in fabrication of products of highest possible quality at the least possible cost.

Advantages of nondestructive tests are that they indicate quality without altering, damaging or destroying the material or product. Many times nondestructive tests have indicated corrective manufacturing procedures. The tests separate acceptable from unacceptable metal parts, assuring usable material and eliminating defective or faulty stocks.

When quality is known, material can be used in structures closer to ultimate physical properties, resulting in designs which are smaller, lighter and more functional.

Such an economical testing program removes all unnecessary frills, unwanted expenditures and employs appropriate skills and effectively accomplishes its purpose.

Nondestructive methods and techniques have limitations, however, whether they are X-ray, fluoroscopy, magnetic particle, fluorescent penetrants, sonic, ultrasonic, eddy current, isotopic or any other. A comprehension of limitations of each method or technique is the basis for choosing the appropriate method to be used and the complementary choice of needed additional testing.

Nature of most nondestructive testing techniques involves interpretation of defects. Some causes may be traced to raw materials, some to processing, and others to manufacturing sequence. These new methods of testing, however, are finding wide application in aircraft, rocket, missile, satellite, petroleum, chemical and other industries.

From a symposium given at the 10th Western Metal Congress, March 1957, sponsored by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

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Molybdenum Alloys Show Promise for Future

By Robert R. Freeman

Manager, Arc-Cast Molybdenum Dev.
Climax Molybdenum Co.
New York, N. Y.

Research sponsored by the Office of Naval Research has resulted in development of molybdenum-base alloys with higher useful strength at temperatures over 1600 F than any other presently known materials. The alloy containing five-tenths percent titanium has the best

high temperature properties of the available molybdenum-base alloys.

Molybdenum already has found applications in the missile field for parts such as nozzles and vanes. Recent progress in development of alloys combined with advances in production and fabrication make it probable molybdenum-base alloys will find much greater use in missiles now on the drafting board.

Various coatings have been developed for protection of molybdenum against oxidation. A useful life of several hundred hours at temperatures up to at least 2000 degrees F appears possible under certain conditions.

Molybdenum can be frabricated by most conventional methods with minor modifications. Satisfactory joining procedures have been worked out and arc-welded joints with some ductility have been produced under optimum conditions.

From a paper given at the 1957 Engineering Management Conference, American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y.

▼ ▼ ▼

Stress Relieving Aircraft Machine Parts

By R. E. Kleint and F. G. Janney

**Production Development Lab.
North American Aviation, Inc.
Hawthorne, Calif.**

Severe warpage and occasional cracking sometimes occur during machining of parts from large aluminum forgings, plates and extrusions for aircraft. Many of these large aluminum parts, do not readily lend themselves to currently practiced methods of stress relief.

Significant stress relief, however, can be accomplished by the compressive deformation of aluminum alloys after heat treatment.

An investigation recently was conducted, which brought out the significant method of using compression for this purpose.

Stress relief by compressive deformation where it is applicable and properly done will compare favorably to stress relief, in other alloys, by stretching. The effect of compressive deformation on mechanical properties should be thoroughly investigated for the particular material for which compressive deformation is being considered.

From a paper given at the 10th Western Metals Congress, L.A., Calif., sponsored by American Society of Metals, 7301 Euclid, Cleveland, Ohio.

Radiation and Human Safety

By Richard H. Chamberlain
University of Pa.
Philadelphia, Pa.

Man made radiations have been with us for only some 60 years. They are rapidly increasing in use for the past 10 years. The coming of age of radiation protection has involved the accumulation of knowledge about radiation effects, the intelligent application of this knowledge, and the development of sensitive and precise methods of measuring radiation.

Radiation is always present in the form of background from natural radioactivity and cosmic rays. The relative safety or hazard of added radiation, above this background, depends on the quantity of radiation and how much energy is absorbed from it by the tissues. This is meaured in units called rads. The effect is also dependent on the volume of the body irradiated and varies greatly with the time.

Another factor has to do with the type of radiation and its relative biological effectiveness (RBE). Finally, the effects of radiation on normal tissues vary with the kind of tissue and the elapsed time after the radiation has been given. Acute effects in sensitive tissues, such as the blood-forming bone marrow, the testis, or ovary may be quite marked and yet gross recovery may occur rapidly. At some level of dosage, reactions are produced in all tissues and, when carried to large enough doses, the effects are lethal.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

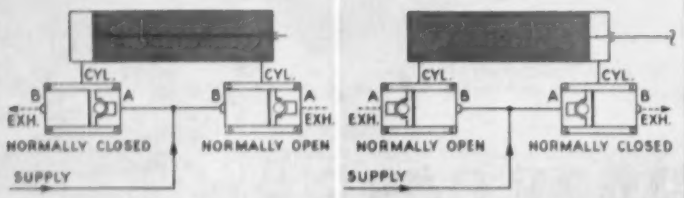
The geneticists have become convinced that mutations in the human race, to an eventual harmful effect, may be increased by low doses of radiation. This presumes that the germ plasm of a large proportion of the reproductive population is exposed. The exact amount of radiation which could eventually result in this harmful effect is not firmly known. Present estimates of the exposure from the combined medical uses of radiations, occupational exposure, environmental exposures, and fallout of radioactivity do not indicate a critical hazard. A long and clear look at the trends and extent of these radiation sources does seem advisable.

From a talk given before the National Industrial Conference Board, Annual Conference on Atomic Energy in Industry, 460 Park Ave., New York 22, N. Y.

Simplified piping

Another Plus Value in NOPAK-MATIC poppet-type air control valves

3-WAY NORMALLY OPEN OR NORMALLY CLOSED

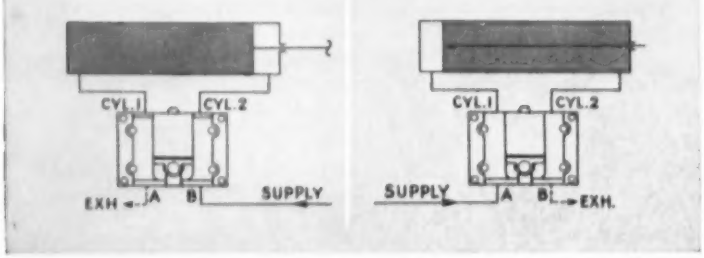


Simply pipe to proper port . . . no change in valve necessary

Piping supply to Port "A" provides Normally Closed operation — supply to Port "B" Normally Open operation. There are no changes to make in the valve . . . just pipe to the proper port. All 3-Way valves have two cylinder outlet ports for piping convenience.

The exclusive Nopak-matic "Flow-Director" pilot head automatically selects pilot pressure from whichever port is used as inlet. It eliminates purchasing special valves for each application or re-assembling of parts.

ELIMINATE CRISS-CROSS PIPING OF 4-WAYS



Simply pipe to proper port . . . no change in valve necessary

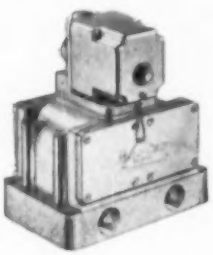
All Nopak-matic 4-Way valves can be piped with pressure to Port "A" or Port "B". Here again, the "Flow-Director" pilot head automatically selects pilot pressure from the inlet port. Flow through the valve is thus changed to meet the application requirements . . . eliminates criss-cross piping to the cylinder. There are no changes to make in the valve . . . just pipe to the proper port.

NOPAK-MATIC Plus Value Valves are available in ¼", ⅜", ½" and ¾" pipe sizes, for 2- or 3-Way Normally Open or Normally Closed operation with master (air), single or double solenoid pilot control heads.

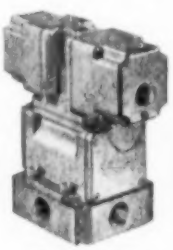
300 SERIES
2-, 3-Way
Master Valves

400 SERIES
4-Way
Master Valves

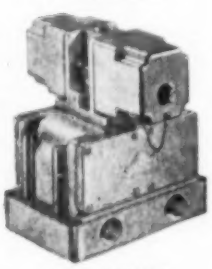
310 SERIES
2-, 3-Way
Single Solenoid
Pilot Operated



410 SERIES
4-Way
Single Solenoid
Pilot Operated



320 SERIES
2-, 3-Way
Double Solenoid
Pilot Operated



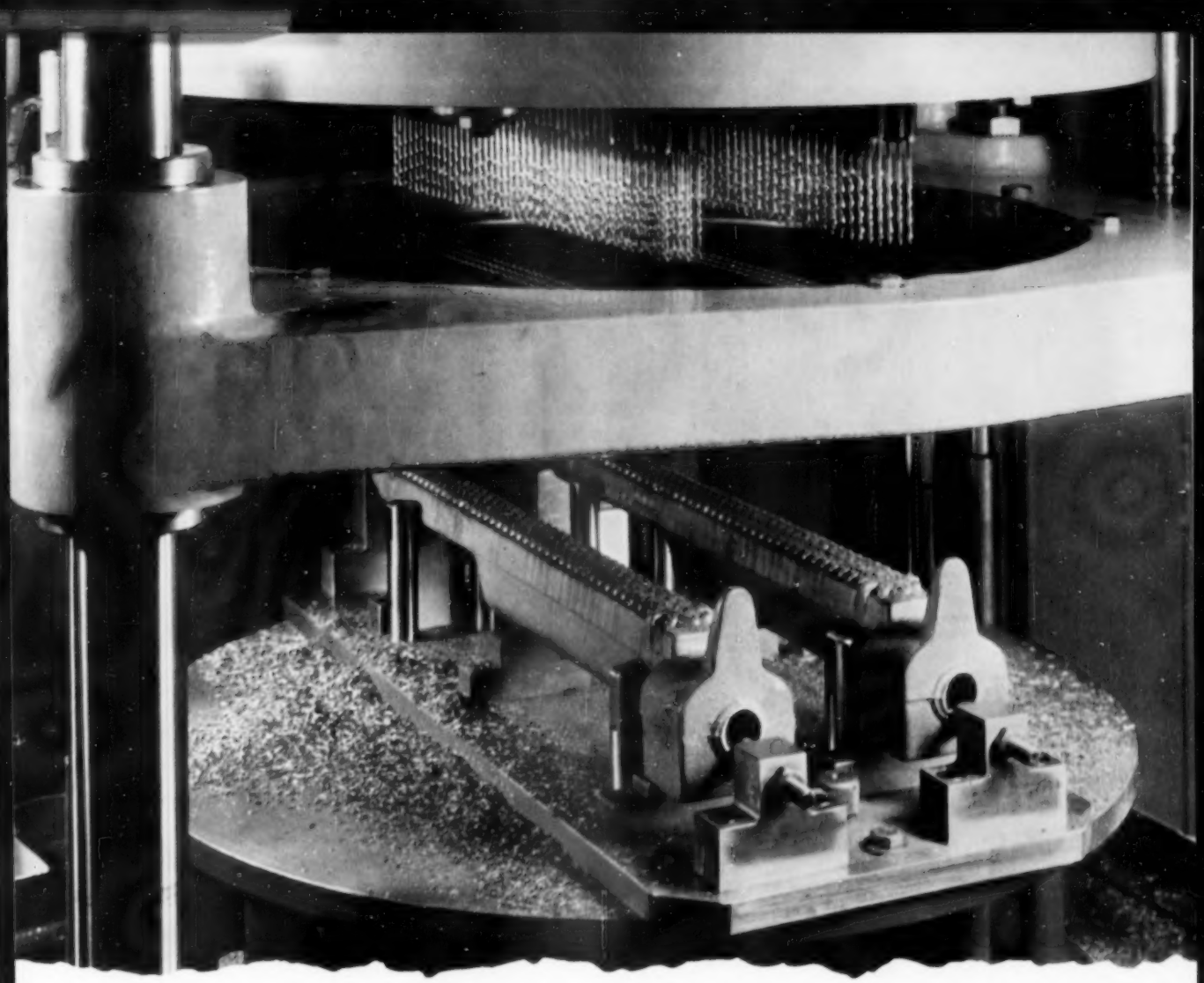
420 SERIES
4-Way
Double Solenoid
Pilot Operated

NOPAK-MATIC valves meet *all* J.I.C. Standards

NOPAK VALVES and CYLINDERS

GALLAND-HENNING NOPAK DIVISION • 2750 South 31st St. • Milwaukee 46, Wis.

Catalog 105 describes in detail all the Nopak-matic Plus Values and gives complete dimensions, installation and parts data. Send for your catalog now. It will be forwarded promptly.



Uniform quality and high performance of CLE-FORGE High Speed Drills can help you reach production quotas

COSTLY "DOWN TIME" REDUCED!

• You can keep your drilling operations *on schedule* with CLE-FORGE High Speed Drills. These fine quality tools give superior performance on *every set-up* . . . and you can rely on their *uniformity* day after day, month after month, year after year.

◈ Why not ask a Cleveland Service Representative for suggestions on reducing "down time" and increasing production in *your* shop? Contact our nearest stockroom, or . . .

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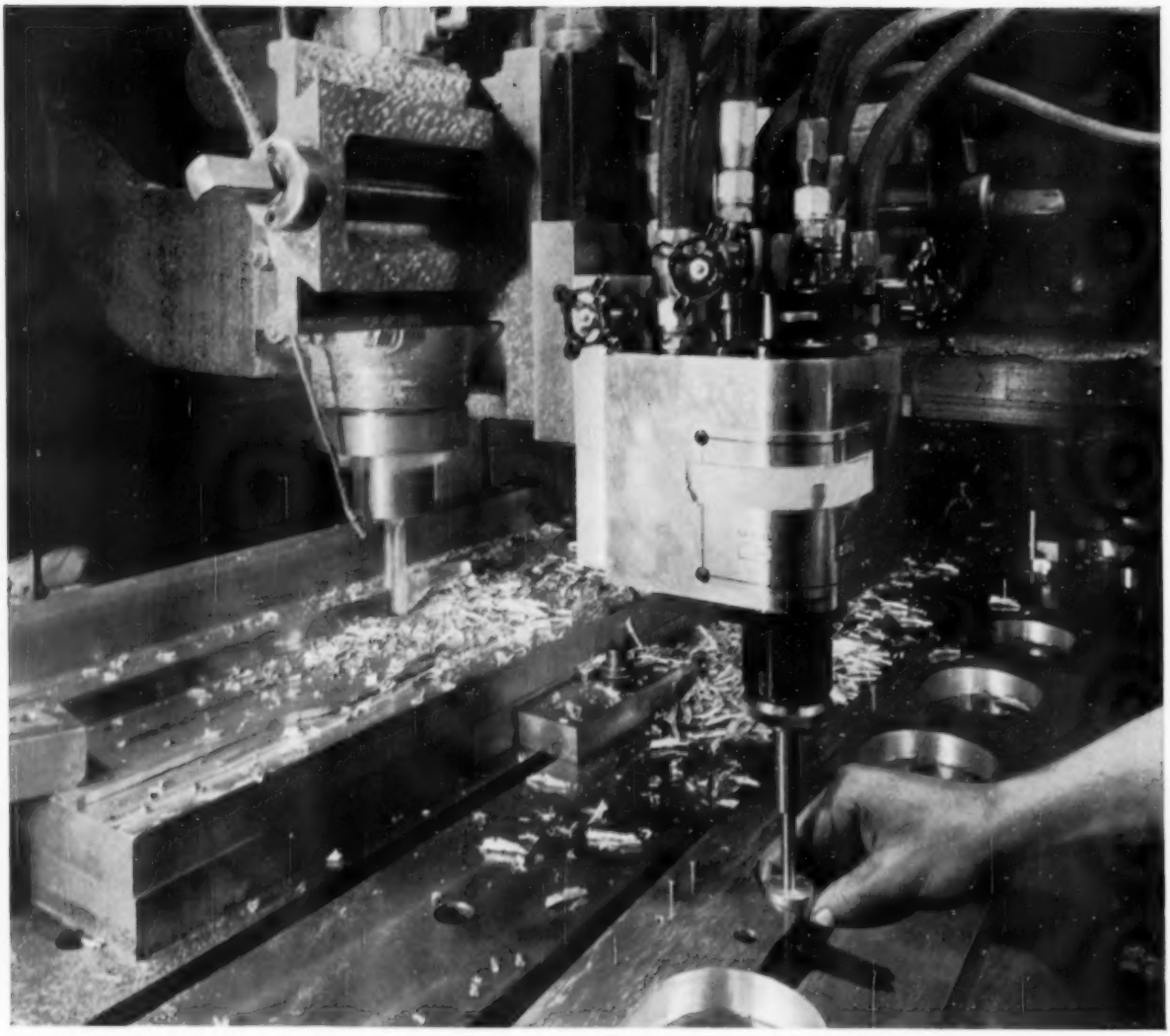

TRACING STYLUS (right) being used on highly accurate magnesium template in profiling operation at American Tapered Wings, Inc.

"Low cost, easy to handle magnesium is an ideal choice for our profile templates"

"We first began using magnesium tooling plate in February, 1956," reports Harold Redpath, Executive V.P. of American Tapered Wings, Inc., Los Angeles.

"We found it entirely practical from the standpoint of strength, and it is lighter, easier to handle and less expensive than either aluminum or steel . . . permits individual workers to move units without using overhead cranes or fork lifts. We used about 7,000 lbs. of magnesium in 1956, saving about $2,000 in tooling metal costs.

"We have been using many of our magnesium templates nine months to a year, profiling aluminum forgings which serve as wing spars, vertical fin spars and longerons. We also use magnesium tooling plate for making many of our drill jigs and milling fixtures."

For more information on low cost, lightweight, easily machined magnesium tooling plate, contact your nearest supplier of Dow magnesium. Or write to THE DOW CHEMICAL COMPANY, Midland, Mich., Department MA 1417U.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. Reliance Magnesium Co., Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.

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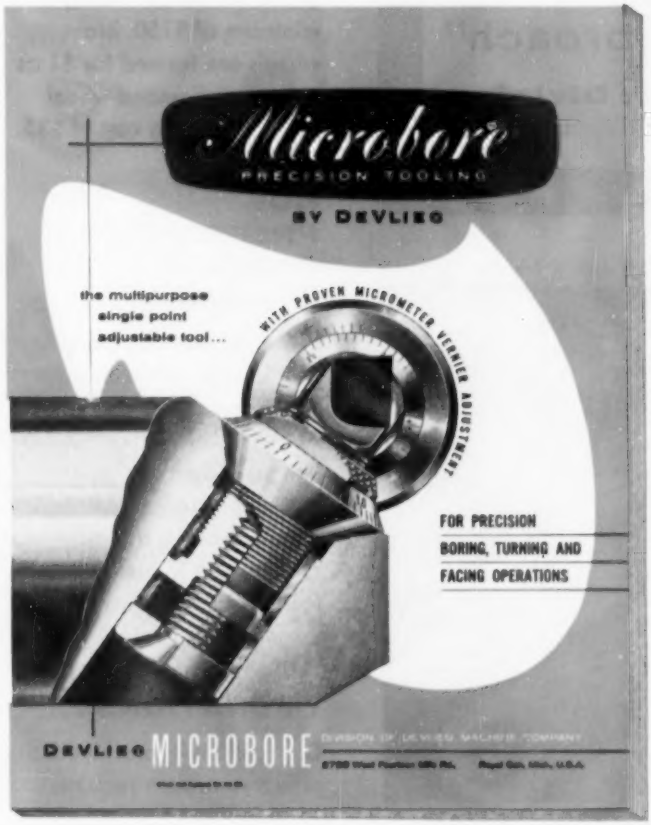
now a completely new DeVlieg Microbore Catalog

listing 332 standard general purpose boring bars

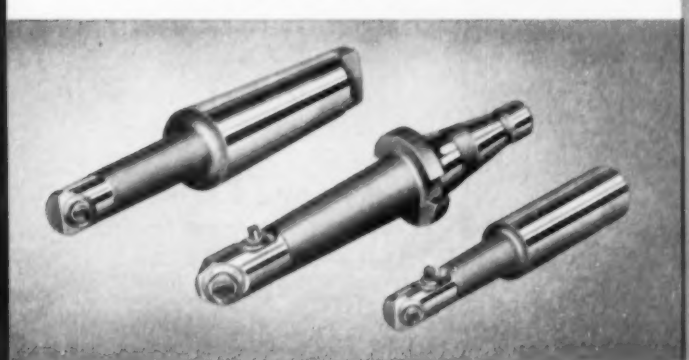


. . . FOR USE ON ALL MAKES AND TYPES OF BORING MACHINES, MILLING MACHINES AND TURRET LATHES!

Yes sir, you'll find it a constant aid. The new descriptive Microbore Catalog No. 58 presents a comprehensive range of newly designed Standard Single Tool and Two Tool Boring Bars, Boring Bar Sets and accessories. It also includes complete application, dimensional and carbide data.

Unique flip charts with simple engineering illustrations make it fast and easy to select the correct Boring Bar with NMTB Taper, Morse Taper or Straight Shank for a specific application.

STANDARD MICROBORE BORING BARS, BORING RINGS AND BORING RING ADAPTERS ARE AVAILABLE SINGLY OR IN SETS



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DIVISION OF DE VLIEG MACHINE COMPANY
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Please send me a copy of your new Microbore Catalog No. 58.

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Namco COLLAPSIBLE TAPS

FOR ROTATING OR STATIONARY-SPINDLE MACHINES

for smooth, clean thread form... fine fit... uninterrupted tapping... on long or short runs

POSITIVE PRECISION— Compact construction and unique core piece design assures rigid, full-length chaser support; heavy body supplies ample side support.

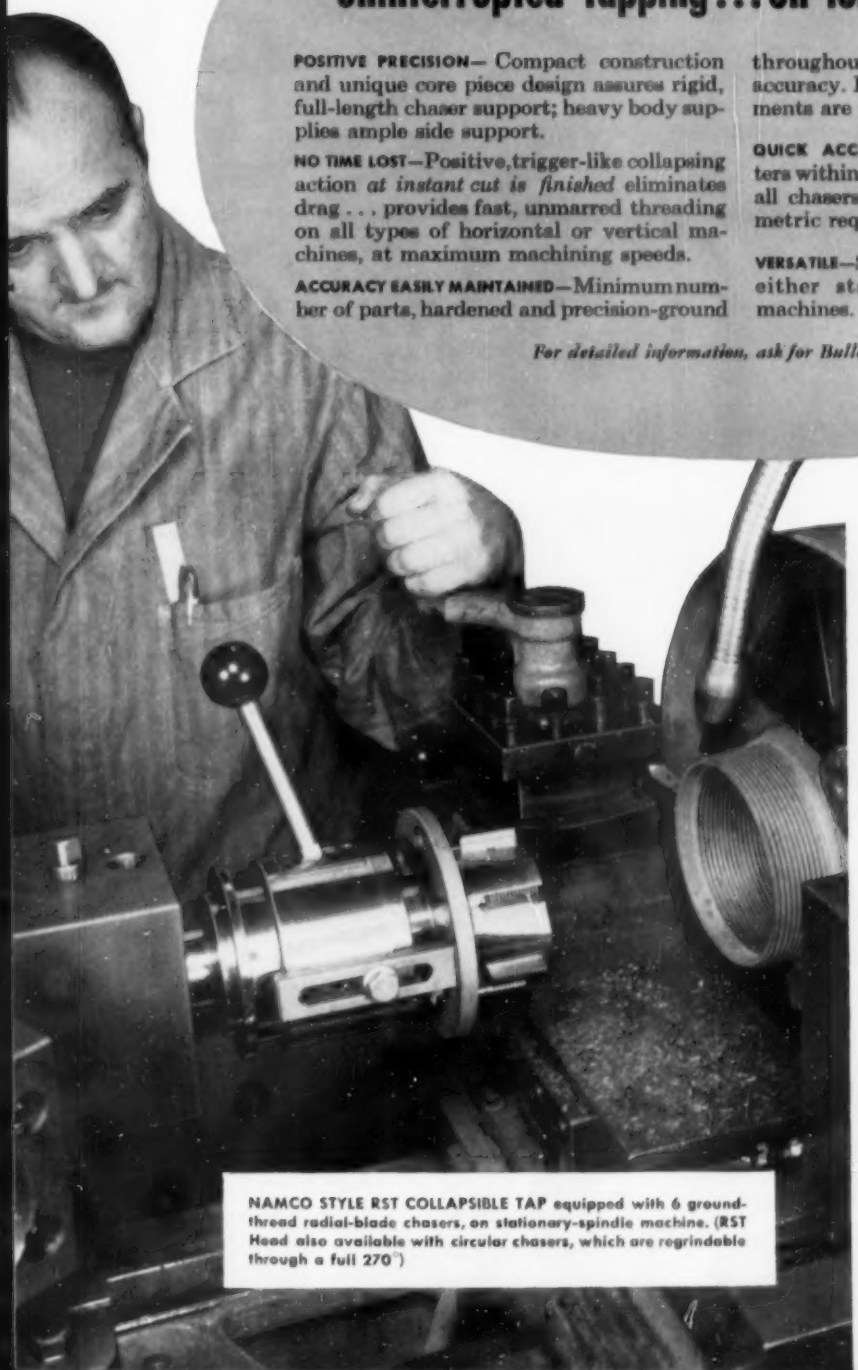
NO TIME LOST—Positive, trigger-like collapsing action *at instant cut is finished* eliminates drag . . . provides fast, unmarred threading on all types of horizontal or vertical machines, at maximum machining speeds.

ACCURACY EASILY MAINTAINED—Minimum number of parts, hardened and precision-ground throughout, assures less wear — greater accuracy. Less down time because replacements are fewer and easier.

QUICK ACCURATE ADJUSTMENT for all diameters within range of head. One screw adjusts all chasers, *simultaneously*, to precise diametric requirement.

VERSATILE—Same RST Head can be used on either stationary or revolving-spindle machines.

For detailed information, ask for Bulletin DT-52



NAMCO STYLE RST COLLAPSIBLE TAP equipped with 6 ground-thread radial-blade chasers, on stationary-spindle machine. (RST Head also available with circular chasers, which are regrindable through a full 270°)

A WIDE RANGE OF SIZES AND TYPES

Style RSA.— Solid, adjustable. Range 1¼" to 4".

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Style RES-L. Ranges: With radial chasers, 2¼" to 4"; with circular chasers, 4⅛" to 13⅜".

National Acme

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184 EAST 131ST ST., CLEVELAND 8, OHIO
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AUTOMOTIVE AUTOMATION...

These two different examples of automatic high production machines demonstrate the imaginative engineering which has earned for Hartford Special such a fine reputation among automotive manufacturers.

But Hartford Special automated equipment is not limited to large plants. The same standard machine components which we use in our own complete machines are available to you as separate elements for assembly into complete machines on your floor. The components include quill type drilling units, lead screw tapping units, power operated index tables, columns and machine bases. Thus the benefit of automated equipment can be had by small plants or by shops faced with diversified mass production.

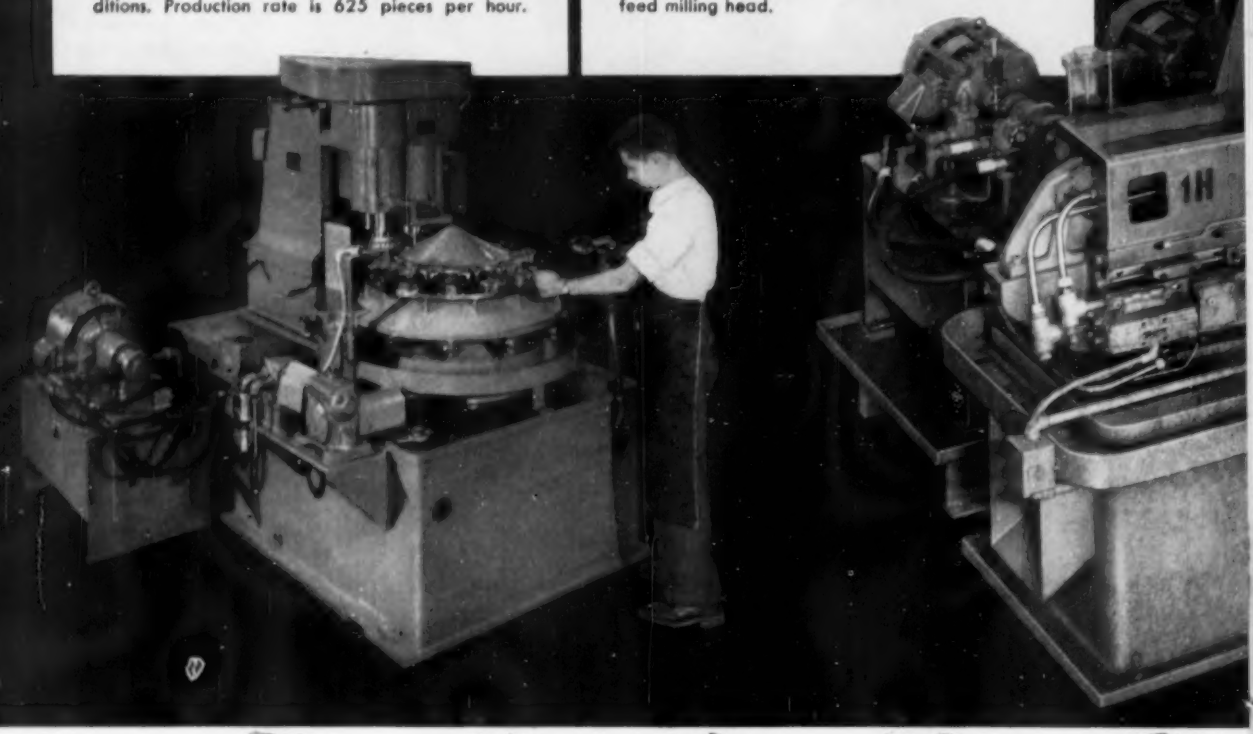
Whichever way you need automation — complete machines or "building block" components — Hartford Special is your most efficient and economical choice.

CONTINUOUS MILLING MACHINE

mills the top and bottom pad of generator end castings. Work is automatically and continuously fed between revolving cutters of variable speed milling heads. Speed of rotation of power table and milling heads can be regulated to suit conditions. Production rate is 625 pieces per hour.

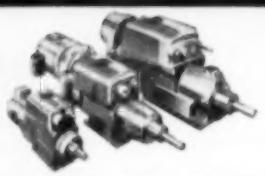
FIVE STATION AUTOMATIC INDEX MACHINE

performs multiple operations on automotive power steering gear box simultaneously. Machining includes angular milling, drilling, reaming, spherical seating and facing. This machine features hydraulic power clamping, automatic lubrication and variable feed milling head.



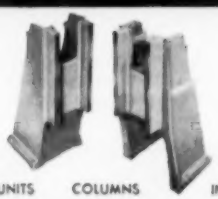
"OFF-THE-SHELF" COMPONENTS BY HARTFORD SPECIAL

Write for descriptive literature.



AUTOMATIC AIR-HYDRAULIC DRILL UNITS

AUTOMATIC CAM TYPE DRILL UNITS



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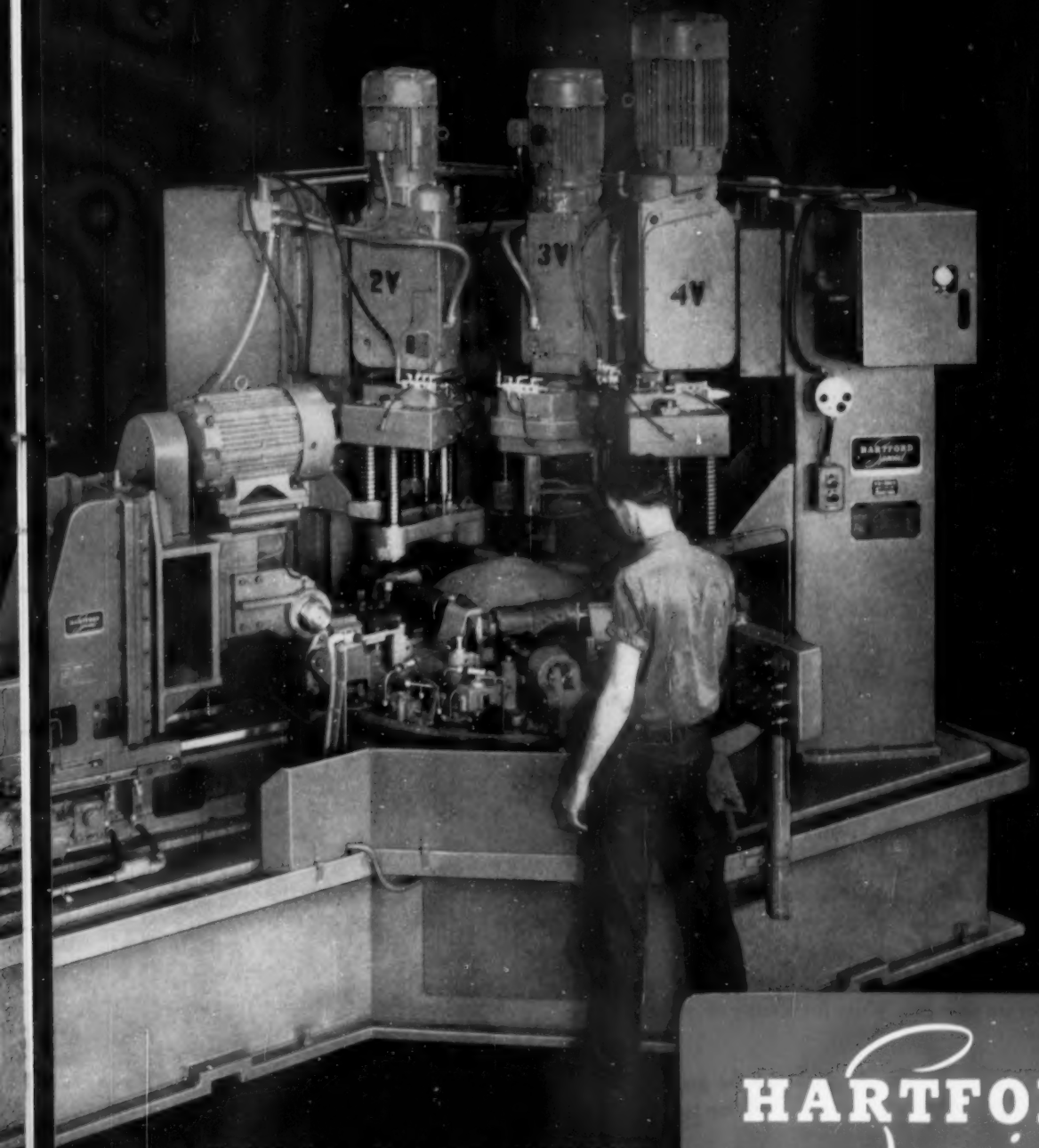
INTEGRAL MOTOR MOUNTS

UNIT MOUNTING ADAPTERS

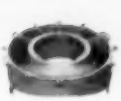
. . . Created by *Hartford Special*



Hartford also makes automatic Thread Rolling Machines and the world famous Super-Spacer

HARTFORD *Special*

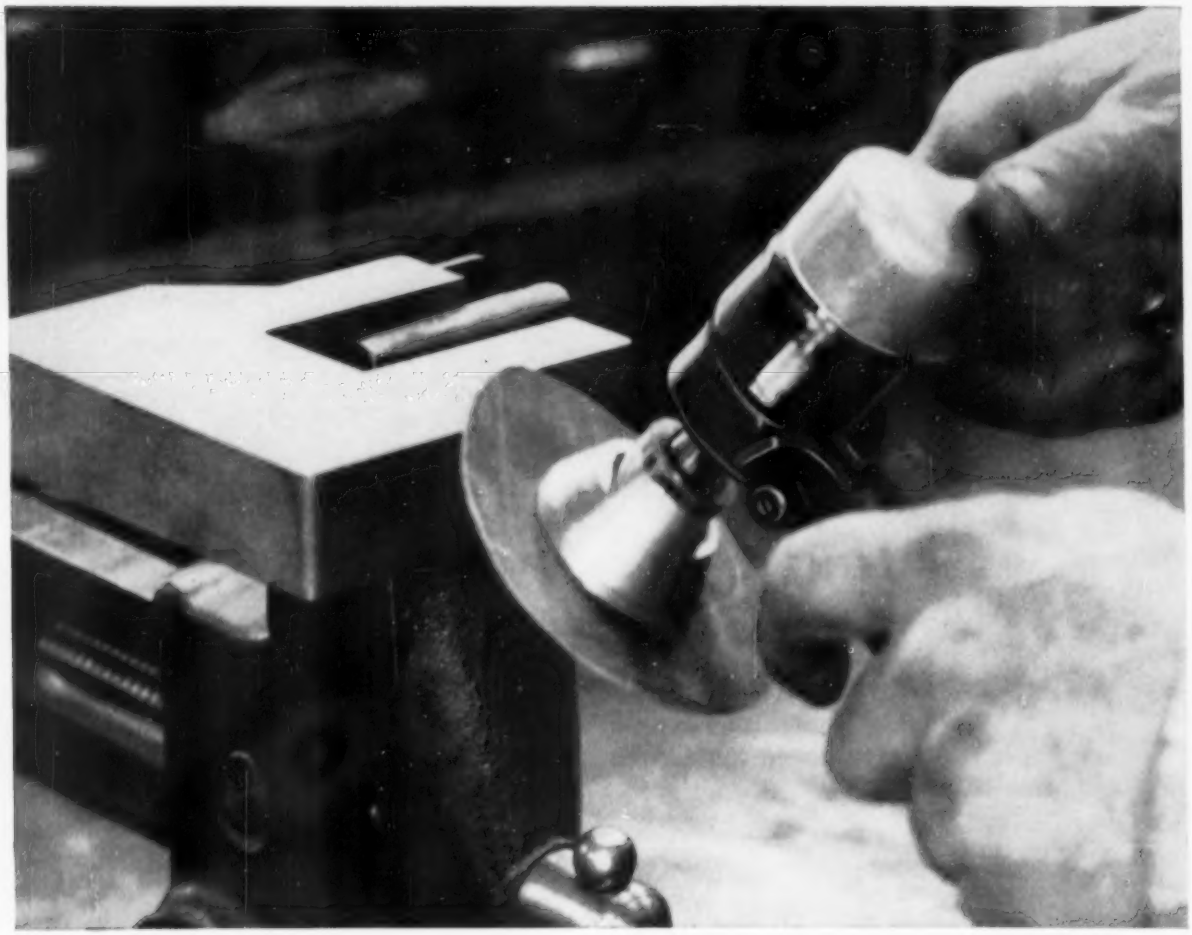
CIRCULAR BASE TOP



INDEX TABLE SUPPORT

PEDESTALS

MACHINE TOOL DIVISION
THE HARTFORD SPECIAL MACHINERY CO.
2807 HOMESTEAD AVE., HARTFORD 12, CONN.



Finishes dies 20% faster... also eliminates abrasive costs

JOB: Putting smooth radius on corners of dies. Formerly used small wheel grinder. Rotor Application Engineer recommended the *right tool*—a Rotor B-02PT 20,000 rpm Disc Sander.

RESULTS: Cut operating time 20%. Light Rotor B-02PT is easier to handle. Gives better finish. Time savings paid for Rotor B-02PT in 12 weeks. Uses 3″ discs, cut down from used 7″ and 9″ discs—a bonus saving of $17.50 per week in abrasive costs.

Why not have a Rotor Application Engineer demonstrate this speedy sander on *your* job. Write for a copy of specifications and Bulletin 53.

Here's the RIGHT TOOL for YOUR job!

Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

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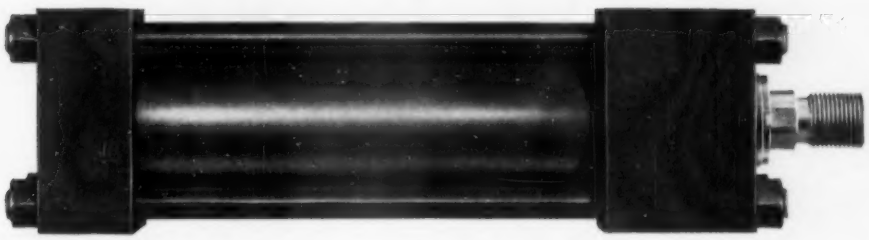


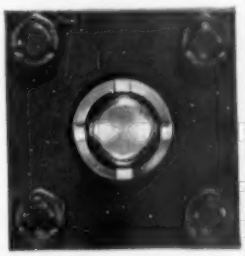
designed for leadership!

The superiority of Hannifin cylinders begins on the drawing board, where Hannifin designers have originated feature after feature not found in other air and hydraulic cylinders. But it doesn't end there...

Hannifin offers more kinds of cylinders, more sizes, more mounting styles. Each manufactured with such exacting control of dimensions and finishes that it not only looks like a better cylinder—its performance proves it!

As more and more discriminating specifiers and buyers are finding, the extra quality you get from Hannifin costs you no more, can usually be delivered sooner.

Why not specify Hannifin by name when you buy?

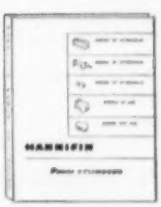


AIR AND HYDRAULIC

HANNIFIN

POWER CYLINDERS

Write for your copy of this new Hannifin Cylinder File—complete, easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Hannifin Corporation, 519 South Wolf Road, Des Plaines, Illinois.

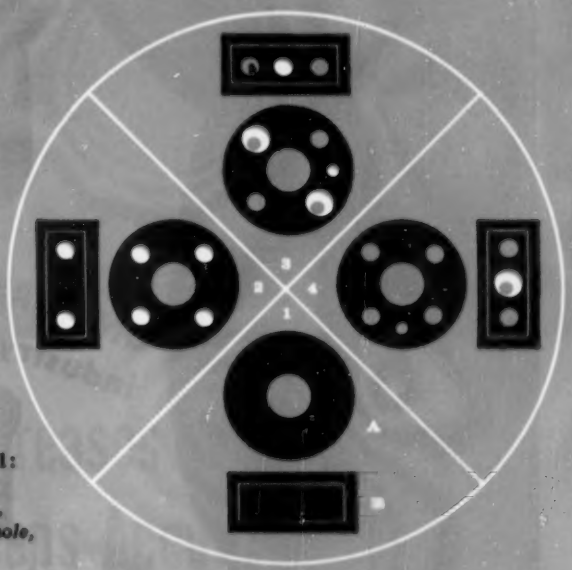


Natco Naturals

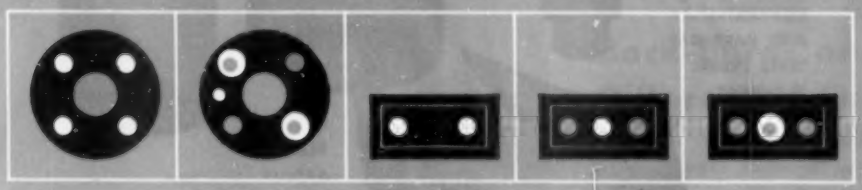
Cost-Cutting Ways
You Can Use
Standard Multi-Spindle Natcos

Any time your parts require machining *more than one hole*—drill, bore, face or tap—it may well be a "Natco Natural." Your standard Natco will produce substantial savings in a surprising number of situations, *even in small job-shop lots!* Call in your nearby Natco field engineer; he'll tell you in short order whether you've got a "Natco Natural" there.

Multiple Drilling Operations on Two Part-faces

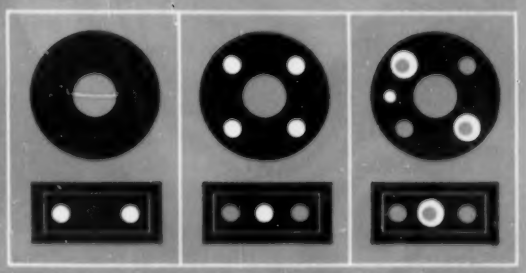


130 parts per hour—4-position rotary table. POSITION #1: *Unload finished part, transfer half-finished part, load new part.* POSITION #2: *Drill 4 holes, Face A. Drill and countersink 2 holes, Face B.* POSITION #3: *Drill 1 hole, ream 2 holes, Face A. Drill 1 hole, Face B.* POSITION #4: *Trepan 1 hole, Face B.*

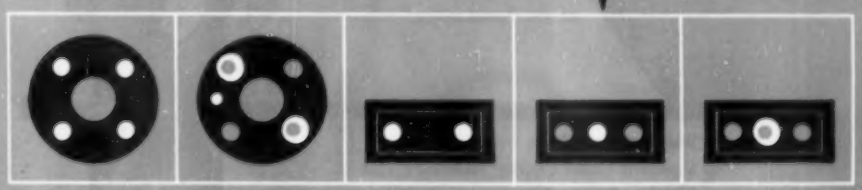


65 parts per hour—stationary fixture *with 5 work locations. Operator transfers parts after each stroke. One part completed per stroke.*

40 parts per hour—straight-line indexing. *After every 3 strokes, operator unloads finished part, transfers half-finished part and loads fresh part.*



23 parts per hour—tumble-type fixture. *Operator transfers and tumbles fixture from one position to the next. One part completed every five strokes.*



Standard multi-spindle Natcos range from 1 hp, 10-spindle machines to 50 hp machines with up to 72 spindles. Spindles in standard Natcos are driven through universal joints and located by either adjustable arms of bored slip plates.

NATCO

National Automatic Tool Company, Inc.

Richmond, Indiana

Multi-spindle drilling, boring, facing & tapping machines. Special machines for automatic production.

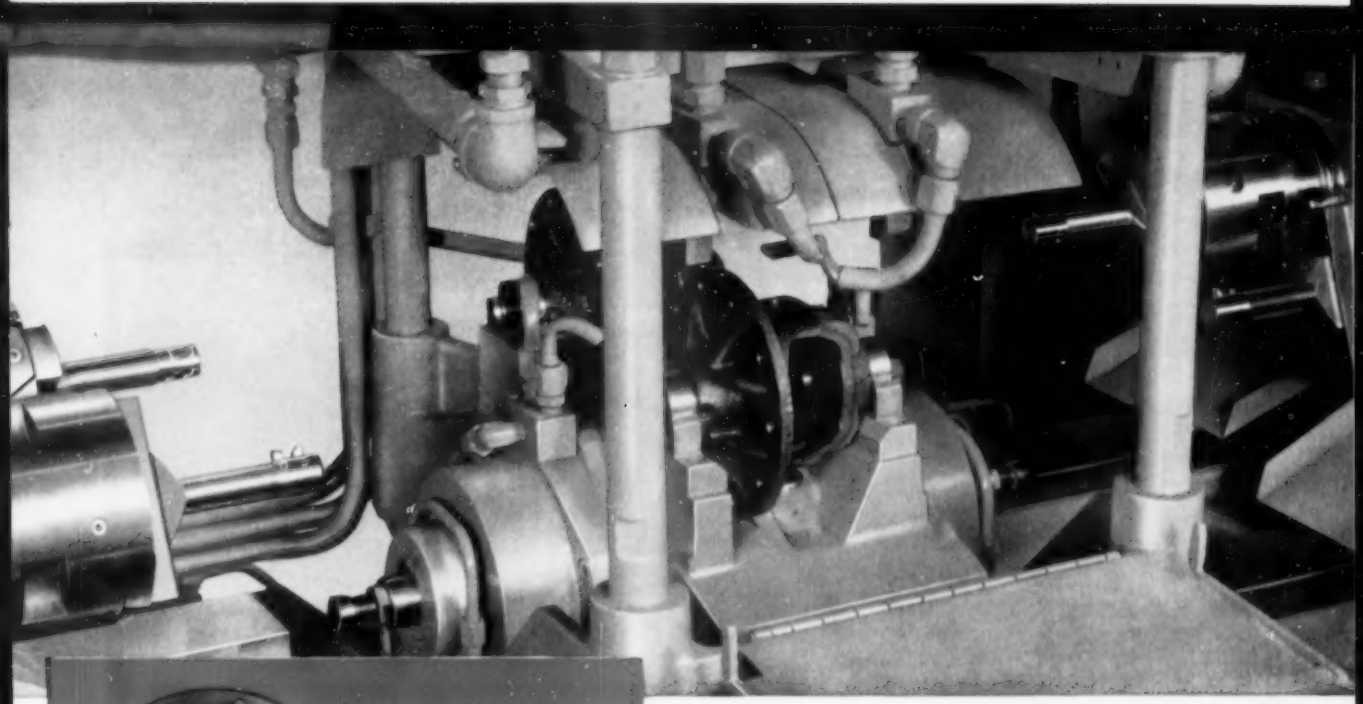
Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.

Universal Drill Bushings are available in a complete range of standard sizes and lengths. Special sizes made to order. Vastly increased production facilities assure immediate deliveries. Write to the office nearest you, Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.

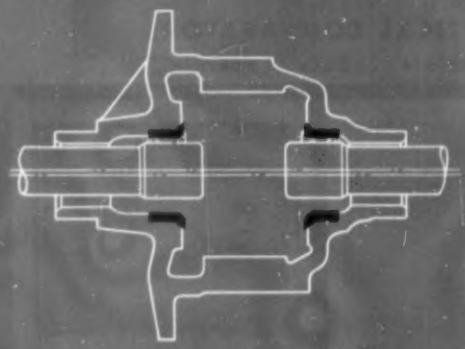
Universal products include:
Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Mikro-Lok Boring Bars, Standard Drill Bushings, and Universal Index Plungers. Write for catalog.

189

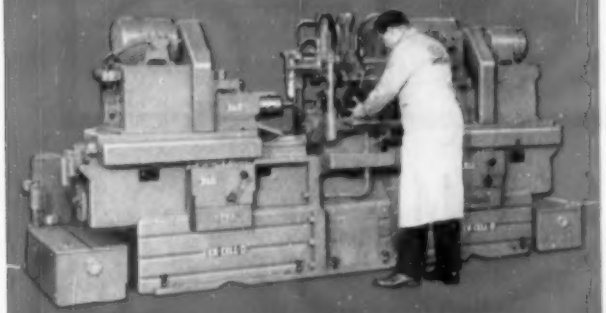
UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 3, MICHIGAN



Above, close-up of parts in fixture. Overhead air clamps in position for loading and unloading. Part shown at left.



Internal boring and chamfering cuts indicated by black lines. Tolerances are held to ± .0005".



Ex-Cell-O Two-Way Precision Boring Machine ups production, increases accuracy.

XLO EX-CELL-O FOR PRECISION

Increases Production, Keeps Accuracy

Back-bores and Chamfers Differential Cases

If you want to increase production, yet maintain .0005" accuracy, get an Ex-Cell-O Two-Way Precision Boring Machine. That's the opinion of an automobile manufacturer.

Right now this machine is performing back-boring and chamfering operations inside steel automotive differential cases for this company. Boring bars enter the case on the center line of the bores, then move 5/32" off center, perform the cutting operations, then withdraw after returning to the center line. Two cases are machined at the same time.

Ex-Cell-O Way Machines perform as one, two, three, and four-way assemblies with exceptional versatility.

These machines adapt smoothly into automated lines, too. See your Ex-Cell-O representative or write Ex-Cell-O, Detroit.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-24

DROODLES

by ROGER PRICE

Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

"SLIDE RULE ON A BENDER"

This slide rule served my Uncle George well for years, until he gave up engineering to become a full-time horse player. His frantic efforts to figure an unbeatable system made the slide rule just another sad statistic, for it fell a victim of digit-alis. George's number was up, too, because between his wife and his handicapping, he was finally nagged to death.

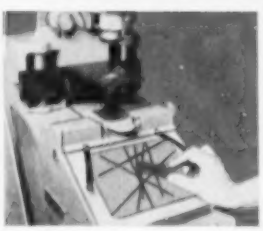
If *you're* being nagged . . . by difficult inspection problems . . . I can put you onto a sure thing. It's the J & L Optical Comparator, a marvelously precise inspection instrument that inspects and measures all sorts of parts and objects, in a range of sizes.

The J & L Comparator spurs production-line inspection, because it's *easy* to operate, is accurate to .0001", and is incredibly flexible and versatile. Eleven models available. Send coupon today for pay-off information.

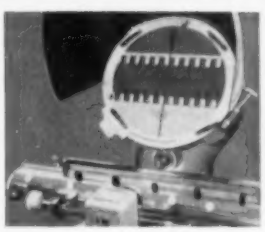
JONES & LAMSON OPTICAL COMPARATORS

Precise . . . Rapid . . . Flexible . . . Easy to operate

Checking keyway tolerances and hole diameter tolerances, as well as their locations and relationships to one another, in the same operation. Multi-base fixture allows rapid changeover for a variety of parts.



Statistical quality control of glass fibres is easy, using a vertical stage on the J & L Comparator. With 250X magnification, .001" shows as ¼" on the screen, and .0001" as .025". Each fibre is measured instantly to .0001".



Long racks or slotted bars are accurately inspected with the Adjacent Reticle Fixture. A precise scribed glass reticle provides rapid lateral indexing. Tolerance lines on the chart indicate variations in individual dimensions.

J&L JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 518 Clinton Street, Springfield, Vermont, U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete J&L line of optical comparators.

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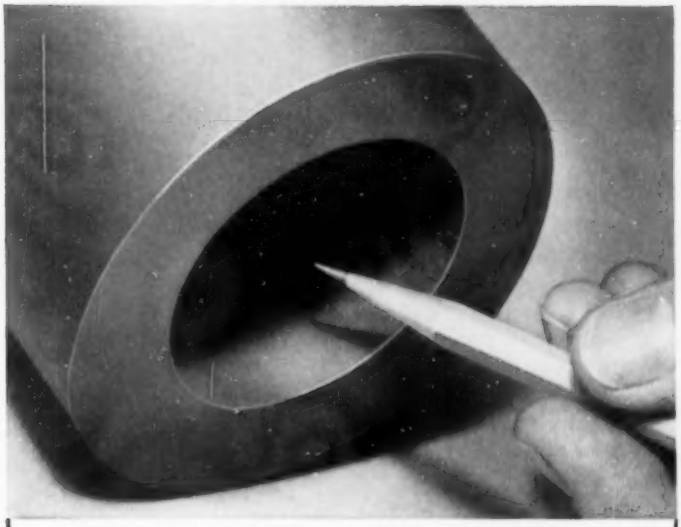
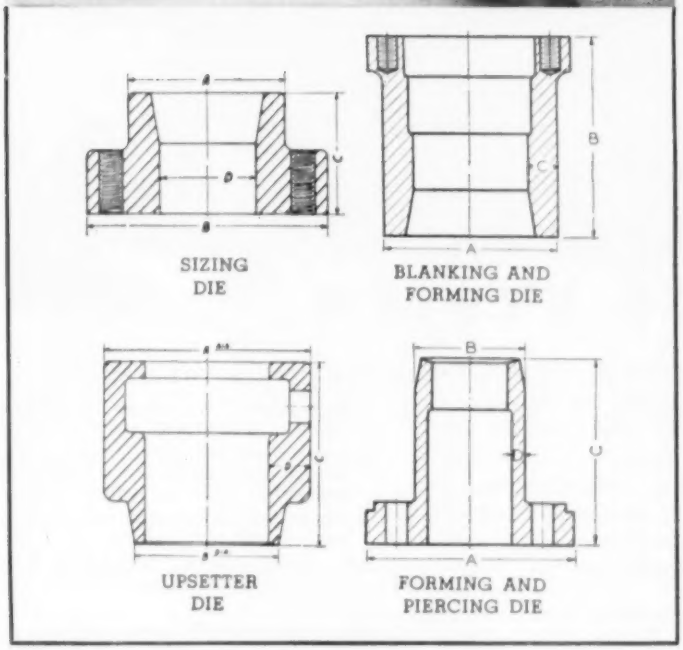
company _____ city _____ zone _____ state _____

SPEED PRODUCTION, CUT WASTE WHEN MAKING RING-SHAPED TOOL STEEL PARTS





New Graph-Mo® Hollow-Bar eliminates drilling, machines 30% faster

IF you make ring-shaped tool steel parts, you'll find that you can speed production, cut waste, and save steel by using Graph-Mo® Hollow-Bar. That's because Graph-Mo Hollow-Bar comes with the hole already in it. There's no drilling. You start with finish boring.

And with Graph-Mo Hollow-Bar you get the combination of proved advantages that have made Graph-Mo one of the most popular tool steels: excellent machinability, exceptional wearability, unsurpassed stability.

Actual tests prove that Graph-Mo machines 30% faster than other tool steels. That's because Graph-Mo has free graphite in its structure. And this free graphite gives Graph-Mo less tendency to pick up, scuff, and gall.

Graph-Mo's amazing wear resistance stems from a combination of graphite and diamond-hard carbides. Reports from users indicate that Graph-Mo outwears other tool steels on an average of three to one.

Graph-Mo also is the most stable tool steel ever made. A master plug gage made from this steel showed less than ten millionths of an inch dimensional change after 12 years in use. And Graph-Mo responds uniformly to heat treatment, too.

Makers of ring-shaped tool steel parts may obtain Graph-Mo Hollow-Bar in sizes from 4 to 16 inches O.D. with various wall thicknesses.

To learn more about Graph-Mo Hollow-Bar, and its application to your problems, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

TOOL CONTROL SYSTEM

Now, from Seibert, you can obtain tool control boards that are individually designed to suit your production requirements. Panels are subdivided into sections for each type of tool, and divisions are arranged as required with space for two sets of tools for each job. Tool panels and benches are available in 3, 6, 9 or 12-foot lengths. In addition, you can now obtain from Seibert pre-setting gages of all types and also optional equipment such as plastic cyclometer covers with locks, drawers, shelves, etc., to suit your specific needs.

INCREASES PRODUCTION EFFICIENCY

Tool Control Boards are a tested and proven method of increasing the efficiency of production machine tools. They provide a system of scheduling tool changes according to pre-determined efficiency standards. You cut down-time, insure longer tool life, reduce tool breakage, and lower scrap losses.

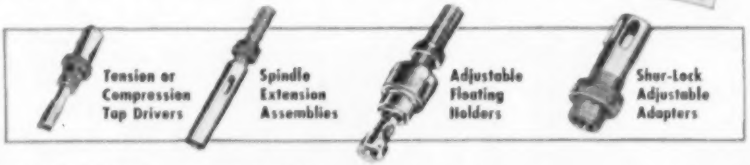
SUMMARY OF ADVANTAGES

- Reduces down-time, provides an efficient system of programming tool changes.
- Automatically controls machining operations; provides visual record of used life of each tool.
- Assures more efficient use of tools, reduces breakage and scrap losses.
- Provides storage and complete facilities for presetting tools at the machine.

WRITE FOR COMPLETE DATA

Get the complete story on new Seibert Control System. Specify circular B-10, or ask a Seibert Sales Engineer to survey your needs.

SEIBERT



SEIBERT & SONS, Inc. 1003 E. 24th Street • CHENOA, ILLINOIS

QUALITY MULTIPLE DRILL SPINDLE AND PRODUCTION TOOLS

New data tells how

STUPALOX ***oxide cutting tools***
cut costs...
speed production!

Now at last! In a handy, well-organized booklet for easy reference—facts, figures and other technical data on the complete line of Stupalox oxide cutting tools and holders.

The amazing performance of these tools—developed by Stupakoff engineers—has established new highs in production and profits for users. They have brought about a new era in cutting tool performance. Faster speeds, deeper cuts, smoother finishes, and longer tool life add up to greater over-all economy. Even capital investment can be lowered, since production levels can be maintained with fewer machines and floor space released for other uses.

This new booklet contains all of this valuable information on one of the most exciting developments in the machine and tool industry during recent years. For your free copy, fill out and mail the coupon below.

STUPAKOFF DIVISION OF
The CARBORUNDUM Company

WHITE DEPT. TE LATROBE, PENNSYLVANIA

SEND *for your FREE copy TODAY!*

Stupakoff Division of
The Carborundum Company
Latrobe, Pennsylvania

Please send me a free copy of Bulletin 257, STUPALOX OXIDE CUTTING TOOLS

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Helical Taper Pin Reamers Shipped by Return Mail

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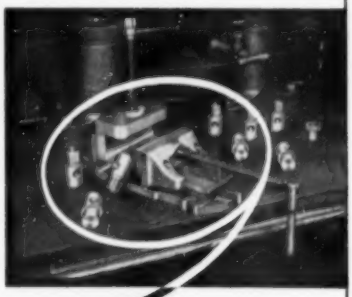
Here's the Secret *



-SPEED VISE- TO LOWER TOOLING COSTS

A simple interchangeable jaw plate and an economical Speed Vise is all it takes to do many of the jobs that normally require expensive box jigs. An assortment of small, inexpensive jaw plates to handle many jobs costs less than the price of one old style box jig... you save tooling costs... you save storage space... you save operating time. Find out today how Speed Vise can save you time and money.

Write today for complete information and prices.

CARDINAL MACHINE COMPANY
1819 Dana Street, Glendale, California

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MIKRON

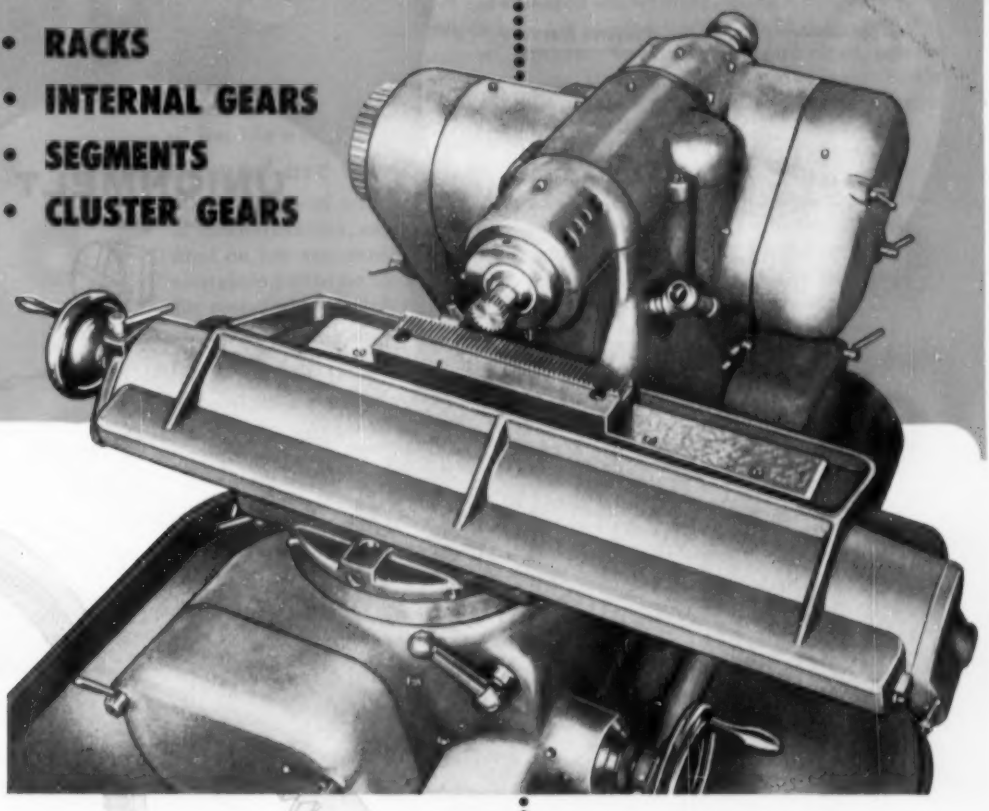
Fine Pitch

RACK & GEAR CUTTER

No. 134

...for

- **RACKS**
- **INTERNAL GEARS**
- **SEGMENTS**
- **CLUSTER GEARS**



ANOTHER machine in the MIKRON line— *Controlled Accuracy, High Finish, Ease of Set-Up.* **The precision cutter shapes as it generates tooth forms. The work meets your most exacting specifications and standards. Gear production requiring a shaping operation will be ideally performed with the MIKRON No. 134.**

WORK PIECE CAPACITY

RACKS
(Straight or Skew)
to 36" long x 1" wide.

SEGMENTS & CLUSTERS
to 3⅛" dia. x 1" wide.

INTERNAL GEARS
to 4" dia. x 1" wide.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

. . . LINDE can supply the *right method!*

Inert gas shielded arc welding—

HELIARC Apparatus for inert gas shielded arc welding, using a tungsten electrode and a shield of LINDE argon, is tops for joining hard-to-weld commercial metals. On stainless steel and aluminum, HELIARC Welding is fast and clean, producing high-quality welds that resist corrosion. HELIARC Welding eliminates costly grinding and finishing, making it a valuable method for quantity production of hard-to-weld metals.

Submerged arc welding—

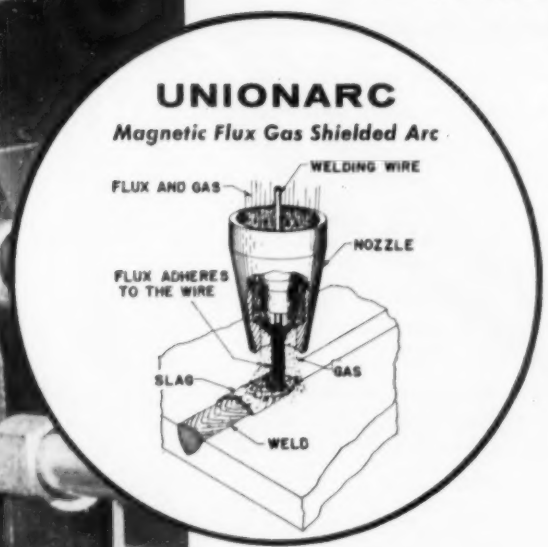
Shapes made of materials ranging from light gage to heavy plate, adaptable to mechanization, can be most economically joined by UNIONMELT Welding. It is used on low and medium carbon steels and alloy steels, including those containing chrome and/or nickel. UNIONMELT Welding is also used extensively for resurfacing metal, providing extra wear and corrosion resistance. UNIONMELT Welding is fast and inexpensive on production jobs.

Shielded inert gas metal arc welding—

One of the most versatile welding methods is Sigma Welding. LINDE's Sigma apparatus, using a shield of LINDE argon, is ideal for manual welding of commercial metals $\frac{1}{8}$ in. or more thick, and for automatic operation on lighter gage metals to .050 in. Highest quality welds can be made on aluminum thicker than $\frac{1}{8}$ in. at speeds up to 16 inches per minute. Build-up and surfacing jobs are also improved by using LINDE's Sigma welding method.

New! Magnetic flux gas shielded arc welding—

UNIONARC Welding, LINDE's most recent development in electric welding, is an extremely fast method for welding mild steel. This method employs a continuously-fed, bare steel wire electrode, magnetically coated with flux conveyed in a stream of carbon dioxide shielding gas. Manual welds can be made easily in any position—vertical, overhead, downhand—with no stops to change electrodes. The speed, versatility, and ease of operation of of UNIONARC Welding brings costs down 25% to 65% below those of manual covered electrode welding. Clean, smooth, high-quality welds are provided, even in the presence of moderate amounts of rust, scale, and moisture.

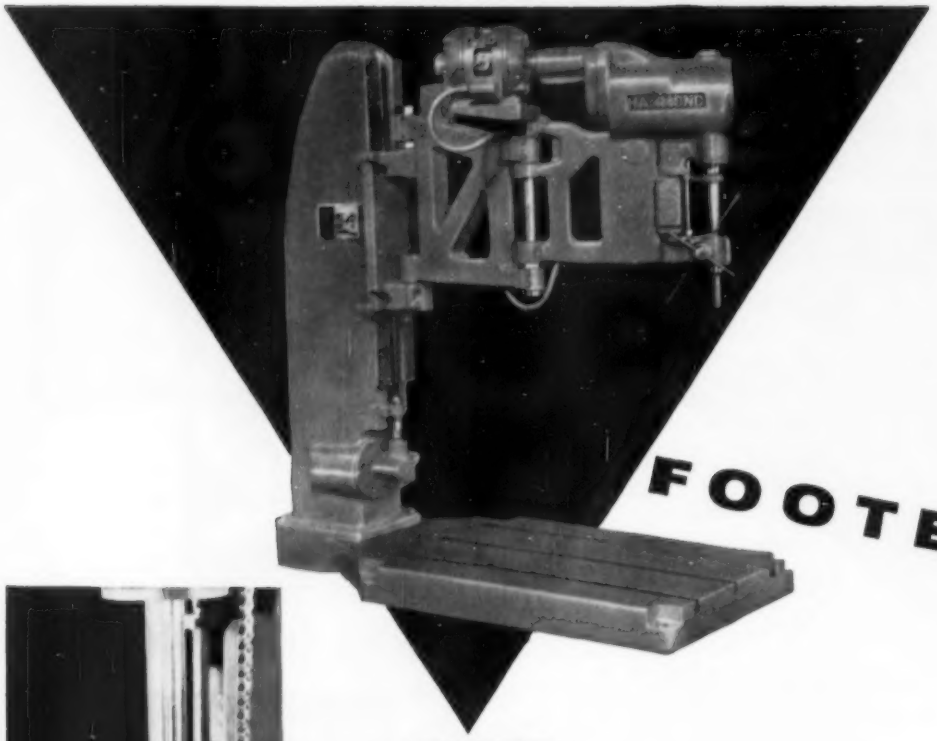


Engineers at LINDE have been designing, developing, and testing electric welding methods and apparatus for many years. Help on any welding method is yours for the asking. You can improve your work and cut production problems by taking advantage of LINDE's experience. For data on UNIONARC Welding or any other electric welding method, call the LINDE office nearest you.

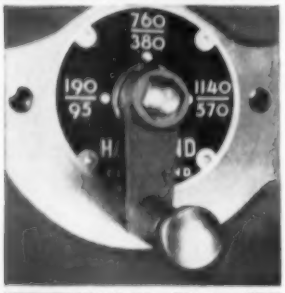
LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. *In Canada:* Linde Company, Division of Union Carbide Canada Limited.

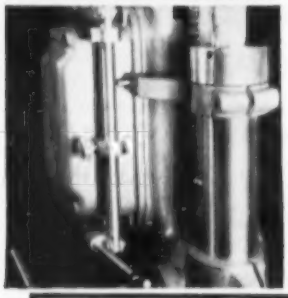
Linde TRADE-MARK

UNION CARBIDE



FOOTBURT





for Faster radial drilling and tapping

Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

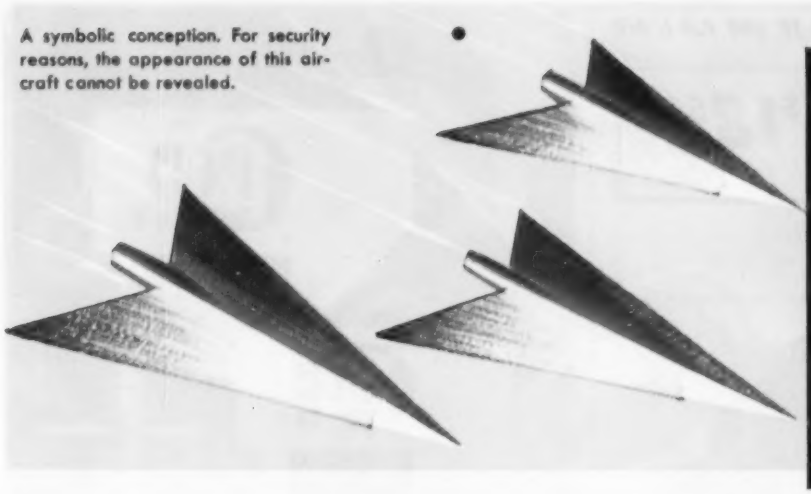
Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

Write for Circular #7A.

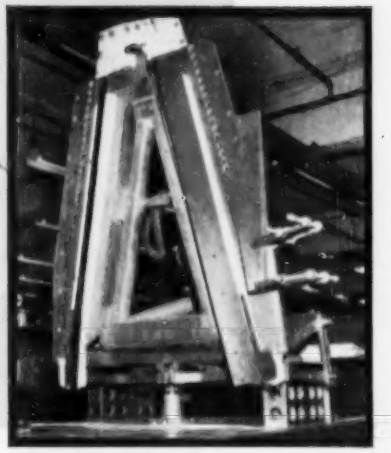
ENGINEERED FOR PRODUCTION

FOOTBURT

MACHINE TOOLS



A symbolic conception. For security reasons, the appearance of this aircraft cannot be revealed.



A master drill and setting gauge, showing use of Epon resins to duplicate compound curves and contours.

In building the supersonic Arrow . . .

Avro Aircraft, Limited saves time and money with

EPON® RESIN

dies, tools, jigs, molds and fixtures

Avro Aircraft, Limited—developing Canada's supersonic Arrow—is achieving major savings with Epon resin tooling.

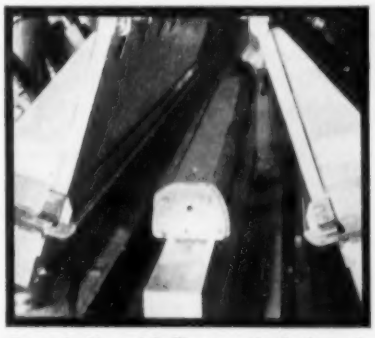
Epon resins provide faster, lower cost preparation of stretch dies, forming tools, drop hammer dies, jigs, duplicate master die molds, checking and assembly fixtures. Avro reports that in making dies of Epon rather than metal, manpower requirements are two-thirds less, which is reflected in correspondingly great savings in the unit cost of tooling.

The Epon resins have an ideal combination of properties for tooling applications. To list just a few:

- Exceptional dimensional stability, high impact strength, excellent resistance to abrasion, minimum residual stress in cured parts.
- Ease and speed of preparation.
- Low shrinkage in filled formulations, assuring perfect master reproduction; minimum warping and stresses.
- Adaptability to repairs and design changes.
- Minimum finishing requirements for smooth surfaces.

Like Avro, other leading manufacturers report savings as high as 80% with Epon resin tools and dies—for *production* as well as experimental and short-run work. Can you make comparable savings in your own operations? Find out by writing for technical literature on Epon resins for tool and die applications.

Epon-faced die requires only hand rubbing to achieve smooth finish. Radii are being touched up with sander.



Stretch die, with Epon resin facing of involved contours, ready for run on 800-ton press.

SHELL CHEMICAL CORPORATION

CHEMICAL SALES DIVISION, 380 Madison Avenue, New York 17, New York

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SHELL

HAYNES Alloys solve the *tough* machining problems

Removing metal fast from hard alloys— HAYNES STELLITE alloy tool removes surface imperfections from a hard chromium-nickel ingot. The 98M2 tool is the only one that will handle this machining job successfully.

Biting off a pound of tough alloy per minute

It takes an unusual tool bit to survive the impact of a deep cut when machining rough alloy billets—and still retain a sharp cutting edge while operating at red-heat temperatures.

Yet HAYNES STELLITE alloy tools handle these jobs in stride. At one plant, for example, they have been the standard tool material for the past 10 years machining 6-inch diameter chromium-nickel billets—a particularly rugged operation. A 98M2 tool completely machines 2½-foot long billets, making cuts that range up to ½ in. deep.

For more information, write for our *Metal-Cutting Tool Manual.* Address Haynes Stellite Company, Division of Union Carbide Corporation, General Offices and Works, Kokomo, Indiana.

HAYNES
ALLOYS
HAYNES STELLITE COMPANY
Division of Union Carbide Corporation

UNION CARBIDE

"Haynes," "Haynes Stellite" and "Union Carbide" are trade-marks of Union Carbide Corporation

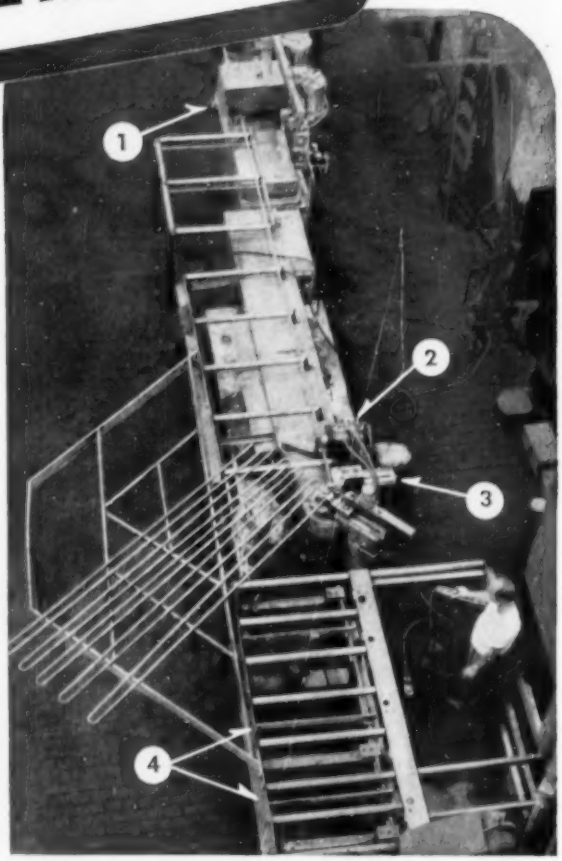
Automation IN COIL BENDING

How Serpentine Coils Are Now Produced in One Continuous Operation on PINES Size 1¼ Production Bender

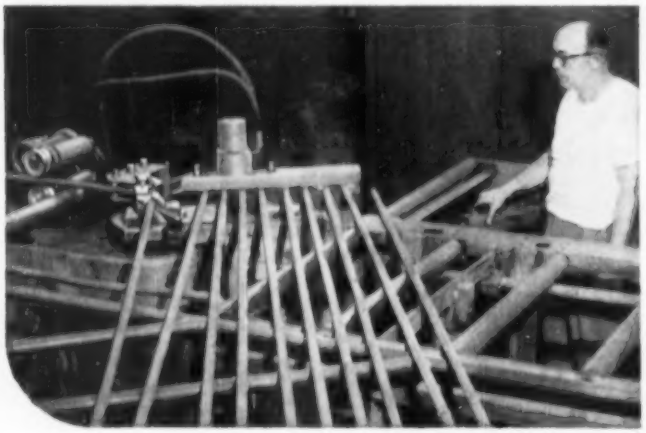
● At Carrier Corporation, Syracuse, N. Y., large serpentine air conditioning coils are now completely formed in one, continuous bending operation on a Pines Size 1¼ Production Bender equipped with a flash welder, automatic feed roll, and turn-over fixture. By former methods, three machines were required to meet production needs, and after bending, from 64 to 128 welds were necessary to fabricate a complete cooling unit. In addition to the slow, inconvenient welding procedure, a considerable amount of stock cutting and work handling was required.

COILS NOW PRODUCED AT 200 BENDS PER HOUR

Today, with the new Pines equipment, complete serpentine coils are now formed with little work handling. Straight lengths of stock are butt-welded together before bending which permits completing the coils in one, continuous operation. This method reduces the number of welds and stock cutting because long lengths of stock are used. Scrap losses are reduced as much as 80%, and since the entire operation is mechanized, work handling is substantially reduced. The result — complete coils are now produced on one machine with two operators at a production rate of 200 bends per hour.



▲ Over-all view of Pines installation at Carrier Corp., Syracuse. Handles standard pipe ranging from ¾" up to 1¼" sizes. The unit combines (1) welder, (2) feed roll, (3) bender, and (4) turn-over fixture.



◀ Closeup view showing automatic feed roll and tooling. Hinged clamp die with angular cam surface and mating plate permits clamping workpiece without interfering with formed coil. Long, horizontal clamp holds ends of coils to prevent distortion during sweep of bending arm.

WRITE FOR *Free* DATA SHEETS

For more information on latest developments in production bending, write for copies of "Pines News". Describes and illustrates how production bending is helping cut manufacturing costs on a wide variety of jobs.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery · 693 WALNUT • AURORA, ILLINOIS

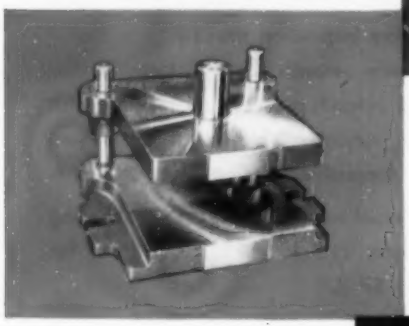
PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

Precision + Interchangeability = Availability

ON NEW DANLY DIE SETS

Danly leadership in die set distribution is made possible by the precision with which Danly sets are made. Precision makes Danly die set components completely interchangeable . . . parts can be stocked by branch assembly plants or distributors throughout the country and assembled for delivery in any of thousands of combinations as standard die sets to meet specific tooling needs. No matter where you are, from New England to California, you get the same Danly precision, the same broad selection, the same fast service.

Inspection stations like this, at every critical stage of production, maintain Danly's traditional accuracy.

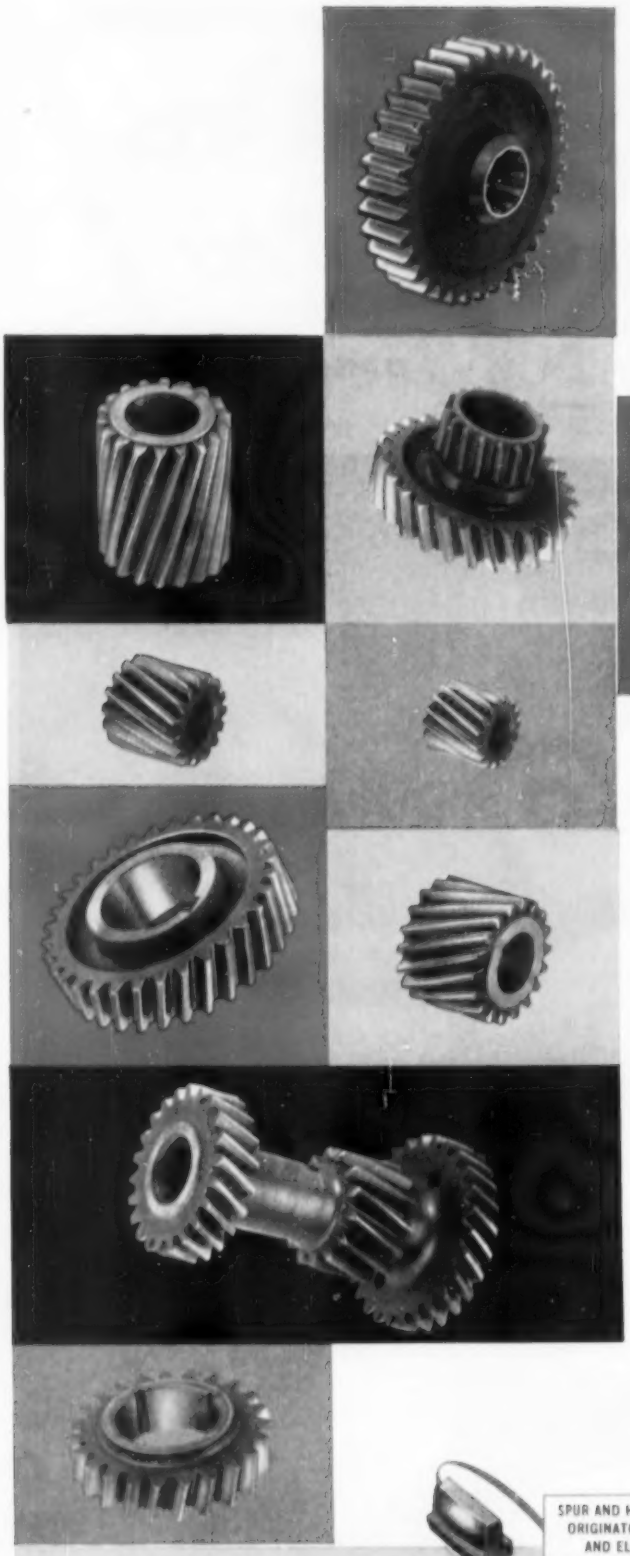


Leading industrial distributors and Danly branch assembly plants—located in all major tooling centers—stock Danly Die Sets for fast delivery.

DANLY MACHINE SPECIALTIES, INC.

DANLY

2100 South Laramie Avenue
Chicago 50, Illinois



GEAR TOOTH NICKS and "HICKIES"

HONING IS THE LOW-COST WAY OF SILENCING THEM

You can hone the average automotive transmission gear in from 15 to 60 seconds. This single operation gets rid of all the noisy nicks and hickies that are so troublesome and tedious to deal with in any other way.

But that's not all. Red Ring honing also improves over-all surface finish—down to 2-4 microinches if necessary.

The initial pass under the honing tool is an effective inspection procedure in that it immediately reveals any distortions that may exist in tooth profile, spacing and pitch diameter runout. When such distortions are not excessive, honing corrects them.

If you want to reduce the cost of silencing noisy gears (1″ to 12″ PD), write for Bulletin H 57-2.

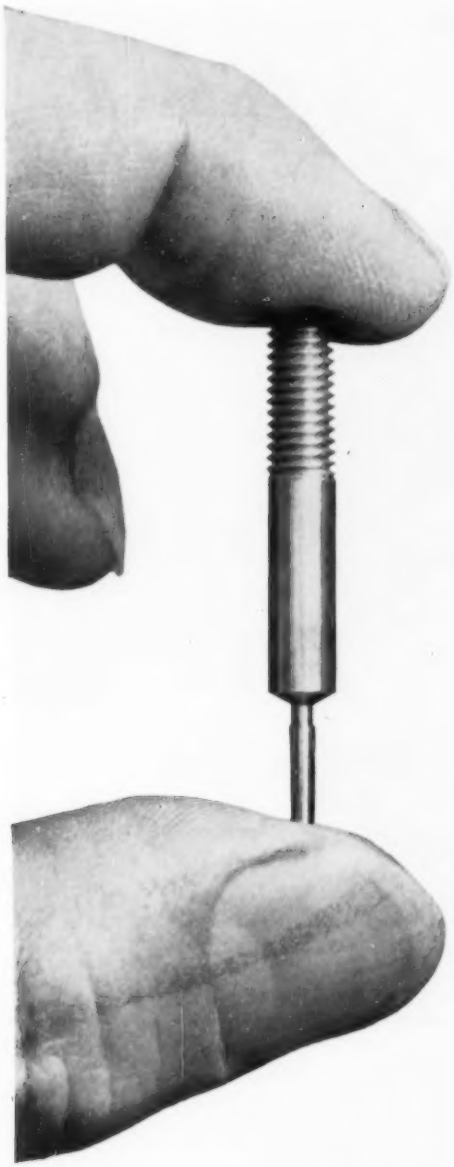
SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

7810

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



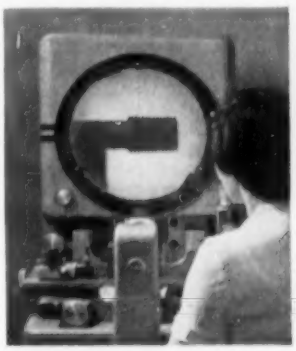
How Minneapolis-Honeywell holds tapers to a tolerance of ± 2′ ...at a glance

Small tapered needle valves at Honeywell's Brown Instruments Division are tough to gage quickly and accurately. Read how optical gaging makes the job easy.

This tapered needle valve is used to reset a pneumatic process control system. Typical dimensions are 1 19/32″ overall with critical taper section less than ½″ long. The actual taper is 2°14′, plus or minus 2′. Since the valve only moves .030″ in regulating flow, accuracy is critical if the flow rate is to be precisely controlled.

This is the sort of measuring job optical gaging thrives on. At Brown Instruments Division of Minneapolis-Honeywell Regulator Company they use a Kodak Contour Projector to check these pieces at the rate of one every 2½ minutes, picking up not only taper but eight other dimensions and concentricity. With optical gaging they find accuracy is greater, since "feel" is eliminated. Production personnel can *see* any variation from tolerance—there's no disagreement between the manufacturing and inspection. And gage wear has been eliminated as a factor in reducing accuracy.

Got a tough-to-measure part like this? Is gaging taking too long or tieing up too many highly trained men? Is inspection holding up production? Optical gaging on a Kodak Contour Projector may be the answer. To find out more about how it can work for you, send for the booklet "Projection Gaging with Kodak Contour Projectors."



A single Contour Projector checks a wide variety of parts simply by changing charts and fixtures.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.
Apparatus and Optical Division

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

NOW...AN ANSWER TO SUMMER RANCIDITY!

Anaerobic bacteria are ready for their annual *summer feast!* Their favorite dish—water-mix cutting and grinding fluids, and their calling card is rancidity. They cost you plenty in the past, by destroying the stability of soluble oil long before the end of normal service life.

But here's a way to put an end to this familiar machine shop free-loader! Just switch to a Stuart Heavy-Duty Water-Mix cutting and grinding fluid with *anaerobic bacteria inhibitor.* Solvol "X," Codol "X," Dasco Super Soluble "X" Base, and the new Dasco D-20 all contain "ABI," and are *guaranteed to stay sweet longer and retain their stability—even in hot weather and through long shutdowns when these bacteria multiply faster!*

GUARANTEED LONGER SERVICE LIFE!

"ABI" in Stuart's water-mix cutting and grinding fluids has been tested and approved by research scientists. Extensive on-the-job use proves it inhibits the growth of anaerobic bacteria because these four Stuart water mixtures last *three to four times longer* than other water mixtures. You are invited to try them on a 100 per cent money-back basis. Don't waste your plant's hard-earned dollars fattening anaerobes *this* summer—ask your Stuart Service Center to recommend the Stuart water-mix cutting and grinding fluid best suited to your operations.

Phone your Stuart Service Center

Arrange now to test Stuart's water-mix cutting and grinding fluids on your difficult machining jobs.

DETROIT, MICH.....Tyler 7-8500
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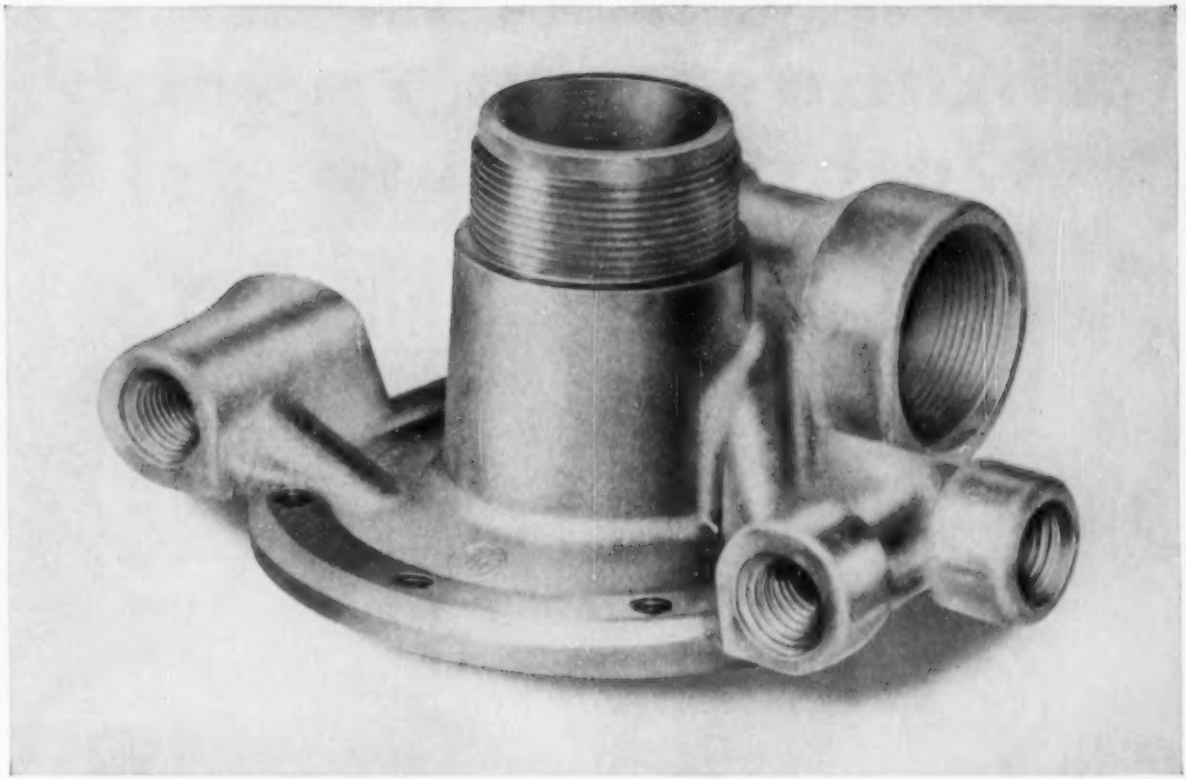
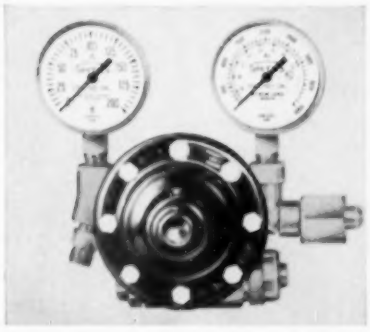


Anaconda Die Pressed Brass Forging after machining, ready for assembly in the gas-pressure regulator shown below.

Better regulators at less cost—with die pressed forgings

Save 25% in first cost—cut machining time, tool cost

Smith Welding Equipment Corp. of Minneapolis uses Anaconda Die Pressed Brass Forgings for gas-pressure regulator bodies as a result of the following analysis of the job.



Smith's two-stage oxygen regulator, Model H313. One of the Smith Welding Equipment Corp. products using Anaconda Die Pressed Brass Forgings.

First, die pressed forgings make a superior product because the twice-wrought metal has the uniformity, denseness, toughness, and strength to prevent gas leaks and to withstand pressures that run in excess of 2500 psi. And second, the forgings do the job economically. The initial cost of the die pressed forging is 25 percent less than the cost of sand castings. In addition, savings are realized in substantially reduced tool costs and machining time. And finally, the forgings are finished in a simple bright-dipping operation, with savings over sand castings estimated at 5 cents a unit.

SHORT CUTS: Anaconda Die Pressed Forgings are short cuts to superior products. Because of their high strength, hardness and resistance to impact, abrasion, and corrosion, they serve better functionally, often replacing more costly built-up assemblies of cast, stamped, drawn, or other machined parts. Their consistent accuracy of dimension eliminates most surface machining to size, permits trouble-free use of drilling jigs, threading or milling fixtures, broaching vises in secondary operations. They are ideally suited to high-speed automatic chucking machines.

The die pressed forging technique is practically unlimited in diversity of shape and field of application. Specialists at The American Brass Company will be glad to submit estimates on the cost of forgings for your critical components. Just submit a sketch or sample of the part involved—or write for Publication B-9. Address: The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

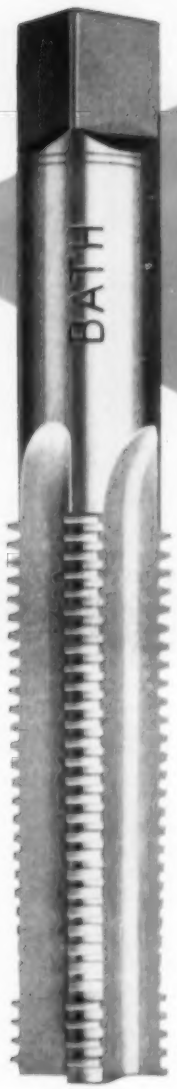
6706

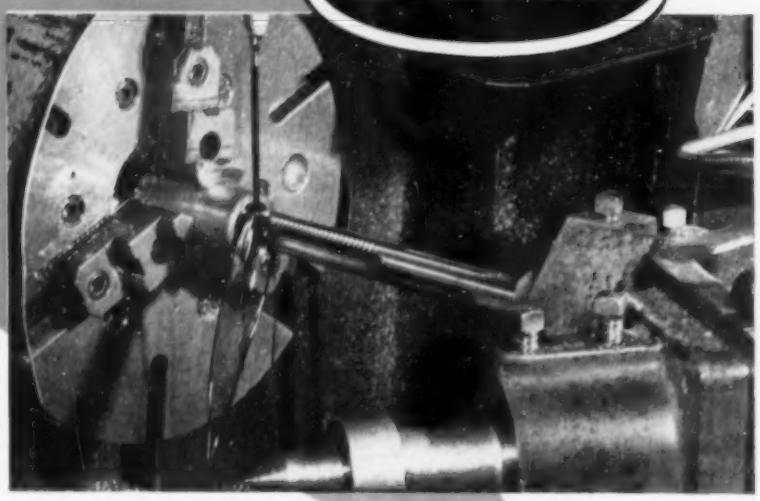
ANACONDA® COPPER ALLOY DIE PRESSED FORGINGS

Short cuts to superior products

another Bath Tap job well done . . for

BULLARD





Bath Acme Tap being used to tap cross rail cross feed nut for Bullard Cut Master Vertical Lathe. Thread: 1⅛"-4 double ¼ pitch, ½" lead Acme thread. Material: SAE #65 bronze.

As a user of Bath Acme taps for about 30 years, The Bullard Company of Bridgeport, Conn., well-known manufacturers of the Cut Master and Man-Au-Trol Vertical Turret Lathes and other modern machine tools states:

> "We have had ample proof of the cooperation of the Bath organization in solving tapping problems, particularly those involving difficult Acme threads. On many jobs, we have been able to produce more efficiently and to improve the quality of Bullard machine parts as a result of special study in tap design by Bath engineers and skilled craftsmanship in tap manufacture."

If you are experiencing difficulty with any of your tapping or gaging, let Bath engineers work with you — as they did with The Bullard Company.

JOHN BATH & CO., Inc.

28 Grafton St., Worcester, Mass.

CYLINDRICAL AND THREAD GAGES · GROUND THREAD TAPS · INTERNAL MICROMETERS

Tear this chart out and preserve it

YOUR GUIDE TO COLUMBIA WATER HARDENING TOOL STEEL GRADES

TYPE AND GRADES	DESCRIPTION	HARDENING RANGE	QUENCH	TEMPERING RANGE	USEFUL HARDNESS
W1 Grade 1 Columbia SPECIAL	Best quality water hardening tool steel — meets all metallurgical tests	1420° F. to 1530° F.	Water and Brine	350° F. to 500° F.	67/59 Rc
W2 Grade 2 VANADIUM EXTRA	Vanadium treated modification of Columbia EXTRA, fine grained, tough, long wearing carbon tool steel	1425° F. to 1500° F.	Water and Brine	350° F. to 500° F.	64/58 Rc
W5 Grade 2 WATERDIE EXTRA	Chromium alloyed Columbia EXTRA for increasing depth of hardness and wear properties	1475° F. to 1525° F.	Water and Brine	350° F. to 500° F.	65/56 Rc
W1 Grade 2 Columbia EXTRA	Extra quality straight carbon tool steel — meets hot-etch and hardenability tests, wide range of uses	1420° F. to 1550° F.	Water and Brine	350° F. to 550° F.	65/57 Rc
W1 Grade 2 Columbia EXTRA HEADERDIE	Selected carbon with controlled hardenability to meet severe physical requirements of cold heading Metallurgically controlled for center soundness	1470° F. to 1550° F.	Water and Brine	400° F. to 530° F.	63/58 Rc
W2 Grade 3 VANADIUM STANDARD	Vanadium treated Columbia STANDARD — a shallow hardening fine grained tool steel for general purposes	1420° F. to 1470° F.	Water and Brine	400° F. to 550° F.	63/56 Rc
W1 Grade 3 Columbia STANDARD	A good quality reliable straight carbon, general purpose tool steel for short run tools not requiring the high physical properties	1420° F. to 1470° F.	Water and Brine	400° F. to 550° F.	63/56 Rc

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILLINOIS

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TOOL COLUMBIA STEELS

COLUMBIA TOOL STEELS

DIE STEELS: Superdie — Atmodie — E-Z-Die Smoothcut — Exl-Die — CEC Smoothcut HOT WORK STEELS: Clarite HW — Formite #3 — Formite #2 — Molite HW10 — Vanadium Firedie — Alcodie — Firedie HIGH SPEED STEELS: Clarite — Vanite — Acmite — Cobite — Maxite — Molite Smoothcut — Molite #3

Shearing capacity of this machine is 12'-0" x ½" mild steel. Note accessibility of two cranks on right end housing. Upper crank is for knife adjustment. Lower one is for back gauge adjustment.

Vinson Steel and Aluminum Co. Dallas, Texas says:

Adjustable Blade Clearance Allows Use of Shear for Complete Range of Thicknesses

THE feature that Vinson Steel and Aluminum Company likes best on their Steelweld Shear is the adjustable blade clearance. This permits them to use the one machine for their complete range of thicknesses. They go as low as 26 gauge galvanized material and up to ½ inch mild steel and ½ inch aluminum.

As a leading supplier of metal in North and West Texas, Vinson insists on cuts being sharp, straight and accurate. This requires that the blade clearance be correct for every thickness cut. Because of the unique easy method of adjusting the clearance on Steelweld Shears, the adjustment can be made in seconds.

Another item which is impressive is the low maintenance cost. This machine has been in service for over two years, and the maintenance has been practically nil.

More and more warehouses are installing Steelweld Shears. Usually one will handle a range of work that would require two or more other type machines not built with a fast knife adjustment feature.

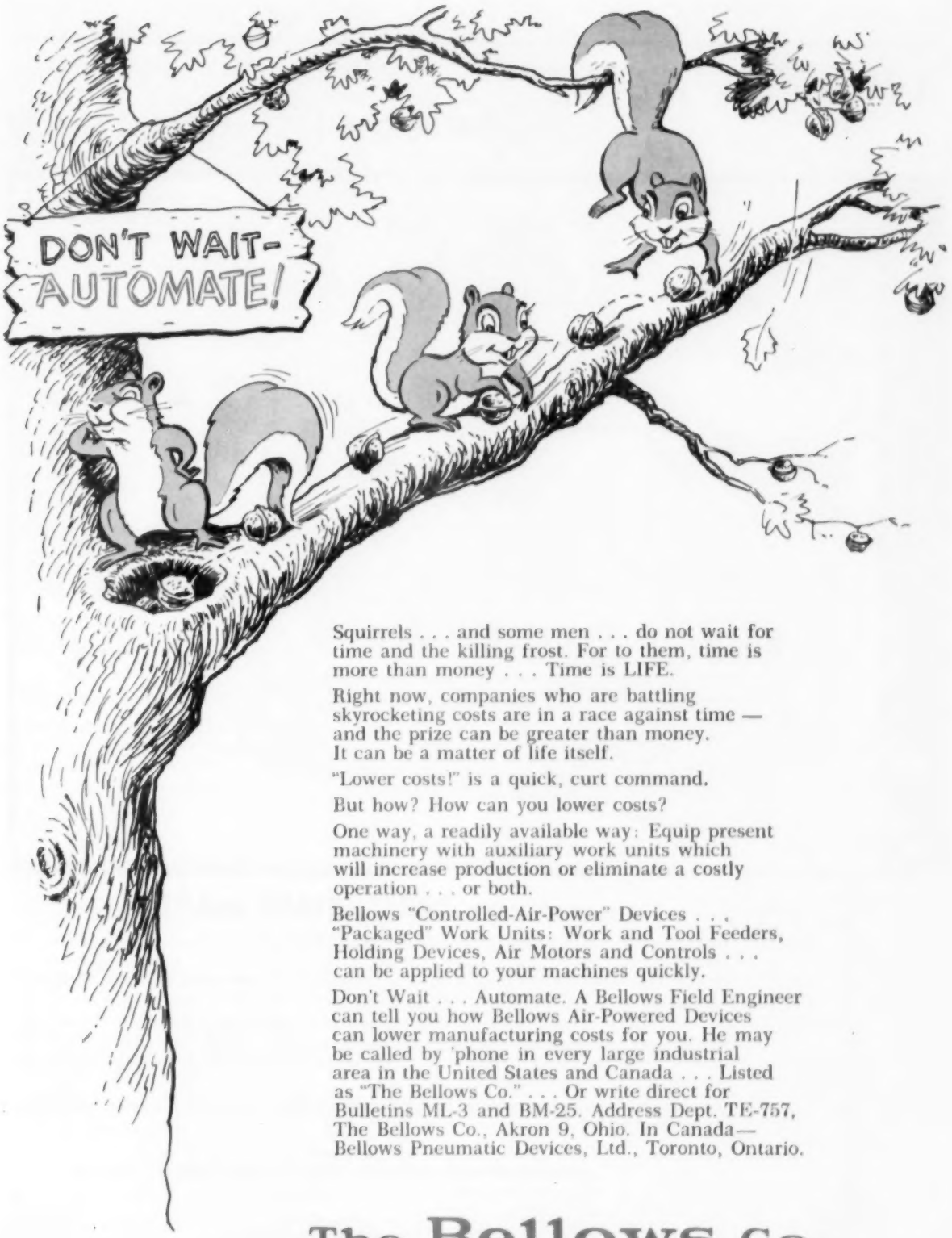
GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

8552 East 282 Street, Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS



Squirrels . . . and some men . . . do not wait for time and the killing frost. For to them, time is more than money . . . Time is LIFE.

Right now, companies who are battling skyrocketing costs are in a race against time — and the prize can be greater than money. It can be a matter of life itself.

"Lower costs!" is a quick, curt command.

But how? How can you lower costs?

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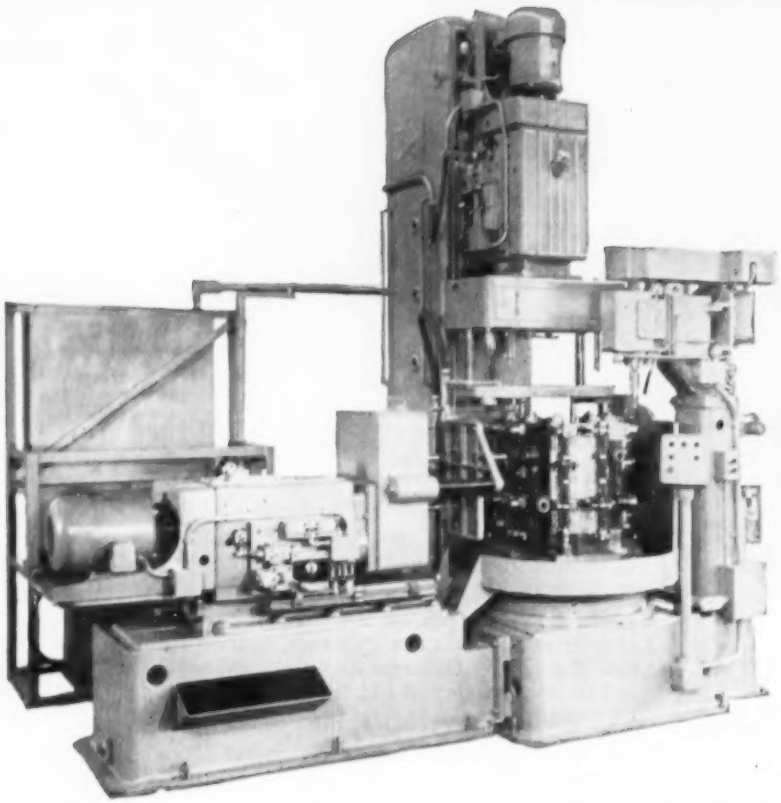

FEATURES

- Economy of construction
- Rigid strength
- Correct drill speeds
- Accurate hole location
- Infinitely variable feed rates
- Completely automatic cycle
- Double work-holding fixtures
- Automatic lubrication

This Special Purpose Machine **DRILLS, REAMS and TAPS**
131 Automotive Cam Shafts per hour at 80% efficiency.

Developed by Standard-Modern, this high production Special Purpose machine drills, reams and taps oil holes in cam shafts at the rate of 26.4 seconds each.

Two cam shafts at a time are loaded vertically into rigid work-locating fixtures, where they are held by clips until manually clamped into accurate position. Pressing the cycle start button indexes the machine through its four work stations where hydraulic drilling, reaming and tapping units advance and feed to depth.

Loading and unloading is done at the first station while drilling, reaming and tapping operations are performed.

STANDARD-MODERN Special Machines are speeding production, saving time and money for industry across Canada.

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FOUR WAYS TO IMPROVE YOUR GAGING PROGRAM

Starrett HIGH PRECISION LOW FRICTION Dial Indicators

1 CUT MAINTENANCE

With fewer parts and interchangeable gear assemblies in No. 25, No. 655 and No. 656 sizes, Starrett Dial Indicators cut maintenance costs. You keep more indicators in service longer with fewer spare parts to stock. The entire gear assembly can be removed as a unit for convenience in servicing.

2 IMPROVE ACCURACY

Simplified design with rugged, rigid construction means Starrett Dial Indicators are less subject to friction and wear. Replaceable low friction jeweled or inserted bronze bearings align accurately to eliminate end play. Rustproof stainless steel gears and tempered pinions, stainless and tempered racks and spindles and heavier bridge and case, all make for lasting accuracy.

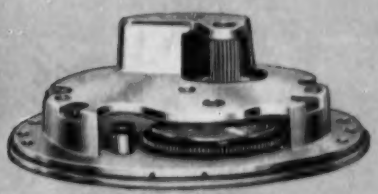
3 INCREASE EFFICIENCY

New easy-reading dials, satin chrome exterior finish and contrasting black bezels help operators read faster and more accurately with less eye fatigue. Count hands on long range models read directly in decimals . . . no calculations.

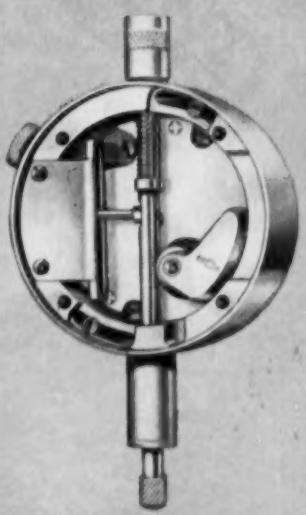
4 IMPROVE PERFORMANCE

Direct acting springs completely around the spindle or rack eliminate cocking and side friction. Action is smoother, more accurate, with less contact pressure. And with the new Nonshock mechanism to stop shock *before* it reaches the gear train, Starrett indicators stand up longer even on brutal gaging applications.

Front view showing easy-reading dial with contrasting black bezel



Interchangeable gear mechanism features simplified unit construction



View with back removed showing inside mechanism

SEND THE COUPON *for catalog describing the complete line of Starrett High Precision-Low Friction Dial Indicators.*

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GREENLEE TRANSFER MACHINES

Change with Your Requirements

THIS MACHINE HAS BEEN REWORKED FOUR TIMES

The "building block" idea of machine tool design has gained much popularity in recent years. Greenlee has long built such flexibility into their transfer machines. For example, the machine shown here has been modified 4 times in 11 years to accommodate changes in product design. Protect yourself from costly obsolescence. Ask Greenlee to show you how.

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TO HELP SOLVE YOUR PRODUCTION PROBLEMS

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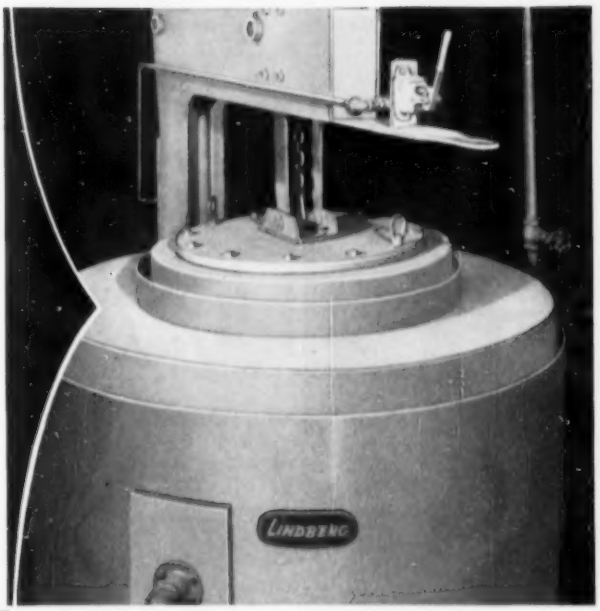
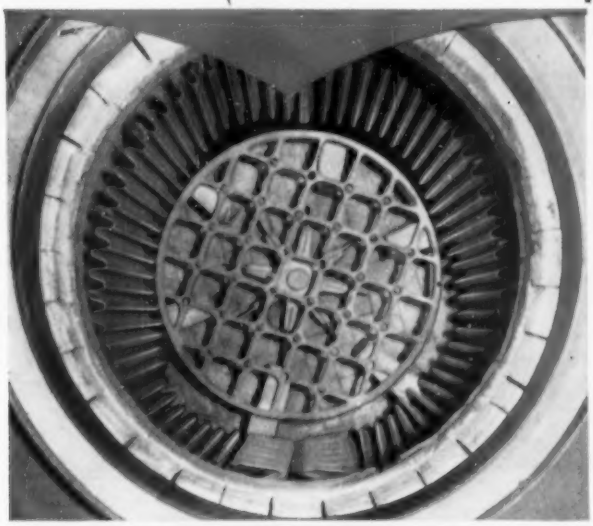
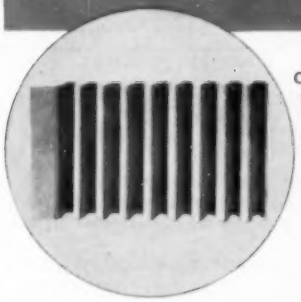
FROM THE OUTSIDE

. . . JUST ANOTHER LINDBERG PIT-TYPE CARBURIZING FURNACE



BUT LOOK INSIDE





CORRTHERM elements operate on extremely low voltage. No leakage through carbon saturation. Shock or short hazards eliminated. No complicated mountings required. An exclusive Lindberg development.

Note how CORRTHERM elements serve as baffles to direct forced convection streams through the charge.

No Retort!

Because it needs no retort, this new Lindberg electric vertical pit-type furnace gives you these important advantages:

- **Lower initial cost, no retort to pay for.**
- **No expensive retort replacement.**
- **Downtime for retort replacement eliminated.**
- **Increased production because it heats faster.**
- **Exact atmosphere control maintains work quality.**
- **Versatile, carbon-diffusing and requenching along with carburizing. Adaptable to variety of work.**

All this is made possible by Lindberg's new CORRTHERM electric heating element. For lower initial cost, lower maintenance costs, faster production, better quality control, why not look into this furnace. It's additional evidence that, if you're concerned with the application of heat to industry, better talk it over with Lindberg.

LINDBERG
ENGINEERING COMPANY

2447 West Hubbard Street, Chicago 12, Illinois

Los Angeles Plant: 11937 S. Regentview Ave., at Downey, Calif.
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Square insert, 15-degree lead angle. Suitable for most boring operations.

Triangular insert for turning to a square shoulder handles other boring jobs.

Easily adapted to multiple insert boring heads for many specialized operations.

KENDEX*

BORING BARS

Kendex Boring Bars bring to turret lathe boring operations all the benefits and economies the Kendex principle is bringing to turning, facing and milling operations.

With the proper grade of Kennametal* "throw-away" inserts, bars can be used for both rough and finish boring of pieces up to several inches in diameter. Almost all boring operations can be handled with only two bars. Special designs are available for special jobs.

Ask for a Kennametal Tool Engineer to demonstrate the operation of this important new family of Kendex tools — or write for information. KENNAMETAL INC., Latrobe, Penna.

*Registered Trademark C-3017

INDUSTRY AND
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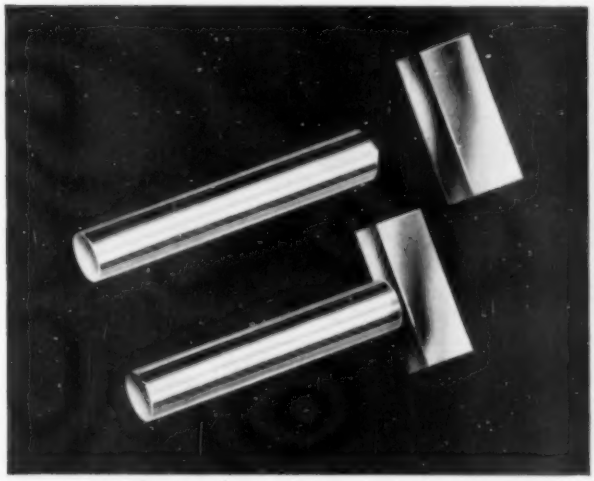
...Partners in Progress

OFFER THESE PRODUCTION BENEFITS

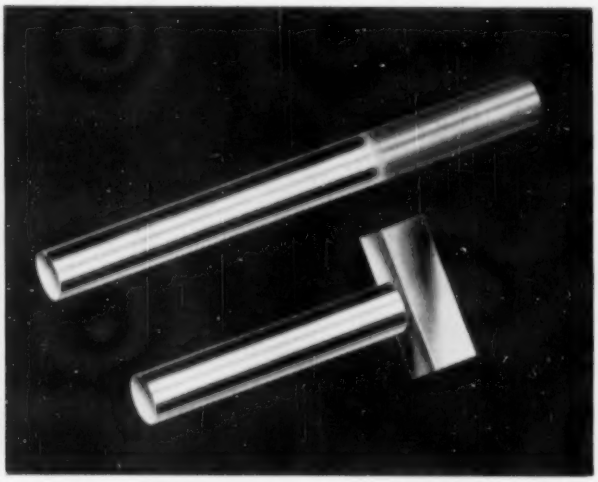
- Suitable for close-tolerance work. Tool can be adjusted while insert remains on center, even when small-diameter bars are used.
- Suitable for heavy stock removal . . . simple design . . . rugged construction . . . hardened alloy steel bar.
- Thinner inserts permit use of harder, more crater-resistant grades with minimized risk of failure due to thermal cracks.
- Cutting point brought down to bar center-line. Standard Kendex chip-breaker plate gives better chip control.

G.R.S. Cuts Costs 65%

with TOCCO* *Induction Heating*



Old Method — headpieces and shanks were butt-welded after shanks were pointed and both parts sandblasted.



New Method — relay cores are formed from barstock heated by TOCCO Induction Heating. No sandblasting or welding is required.

● When General Railway Signal Company converted from butt-welding to TOCCO Induction Heating to form this relay core, they not only produced a better product, faster—but saved money doing it.

Faster Production — A 75 kw, 10,000 cycle TOCCO unit heats 4⅝" of this 9⅞" long, ¾" diameter silicon steel bar to 2100° F. for upsetting magnetic relay cores. 40 kw of high-frequency energy is used, producing 250 pieces per hour—nearly three times the production achieved by their former method.

Lower Cost — Formerly G.R.S. cut separate shanks and rectangular headpieces for this relay core. The shanks had to be pointed and both pieces sandblasted prior to butt-welding. Heating the blanks for forging with TOCCO saves nearly two-thirds the cost of this former method.

TOCCO is Flexible — The part shown is only one of nearly 300 that G.R.S. is heating for forging with TOCCO. Production runs vary from 15 to over 50,000 pieces.

It may pay *you* to investigate TOCCO as a sound method of improving product quality, increasing production and reducing costs.

TOCCO

JUST PUSH A BUTTON

THE OHIO CRANKSHAFT COMPANY

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Please send copy of "Typical Results of TOCCO Induction Heating for Forming and Forging".

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The reason? Macklin's abrasive experience and modern-as-tomorrow productive capacity. Each wheel is expertly engineered and precisely manufactured to assure you top results, wheel after wheel, job after job.
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V-8
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Macklin's V-8 Wheel is tops for all carbide grinding. Test it on your job today. WRITE
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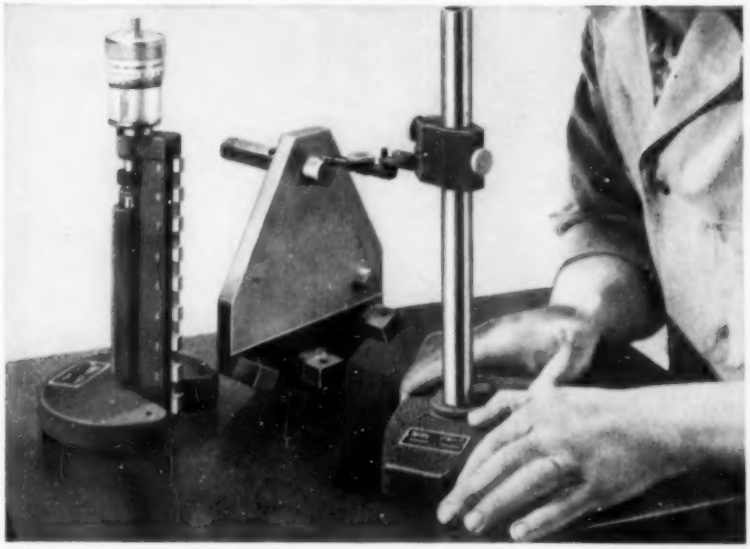
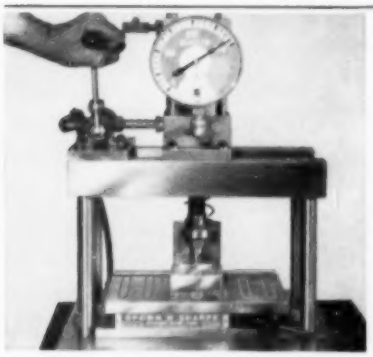
Precision Tool News

REPORTING NEW DEVELOPMENTS AT BROWN & SHARPE'S PRECISION CENTER



Brown & Sharpe Hite-Set and Hite-Chek Speed Accurate Height Measurements

Measuring blocks of the B & S Hite-Set are permanently fastened in a sliding carrier that is actuated for height by a super-accurate micrometer head with 1" range and which reads directly in .0001". The blocks are spaced 1" apart and are exactly .5000" high, enabling settings to be made from top or bottom surfaces, both of which are finished. Blocks are accurate to within .00005" throughout. Hite-Sets are available in 10" and 20" sizes. A companion tool, the B & S Hite-Chek is used to transfer height settings to the work piece with dependable accuracy. Its chrome-plated post, set in a rugged base, carries a reversible slide which has an integral dial indicator holding arm with supports for cylindrical hole and ball socket type swivel clamps. Fine adjustment screw has range of 1/16". Over-all range is 14".



B & S Permanent Magnet Chucks Excel in Holding Power Tests

A series of tests was made recently, to determine the relative holding power of new Brown & Sharpe permanent magnet chucks. Measurement was made of the pull required to lift a steel block, 3" x 2" x 1", from each chuck tested.

The new B & S chucks won in a walk-away. Their holding power far surpassed any other permanent magnet chuck, as well as all electromagnet chucks with standard pole spacing.

150 New Sizes Now Available in B & S Ground Flat Stock

The number of sizes in which Brown & Sharpe precision-ground oil-hardening flat stock is available has now been doubled, making this free-machining, easy-hardening steel considerably more convenient and economical than ever before. 298 sizes, in thicknesses ranging from 1/64" to 3" and widths from 1/2" to 14", will suit almost every requirement. All pieces are 18" long.

Watch For More Precision Tool News

In the past 18 months, Brown & Sharpe has introduced 33 new products, totaling 393 new items, to our industrial products line. This newsletter is the first in a series that B & S will publish to help you keep informed about these up-to-the-minute precision tools and related products.

You are invited to write us for further information on any B & S products, or for prompt help in meeting your special requirements. Better yet, plan to visit our big new Precision Center in Providence, where *all* B & S products can be seen and demonstrated in action. Brown & Sharpe Mfg. Co., Providence, R. I.

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American Society of Tool Engineers

1958 TOOL SHOW

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May 1-8, 1958

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Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

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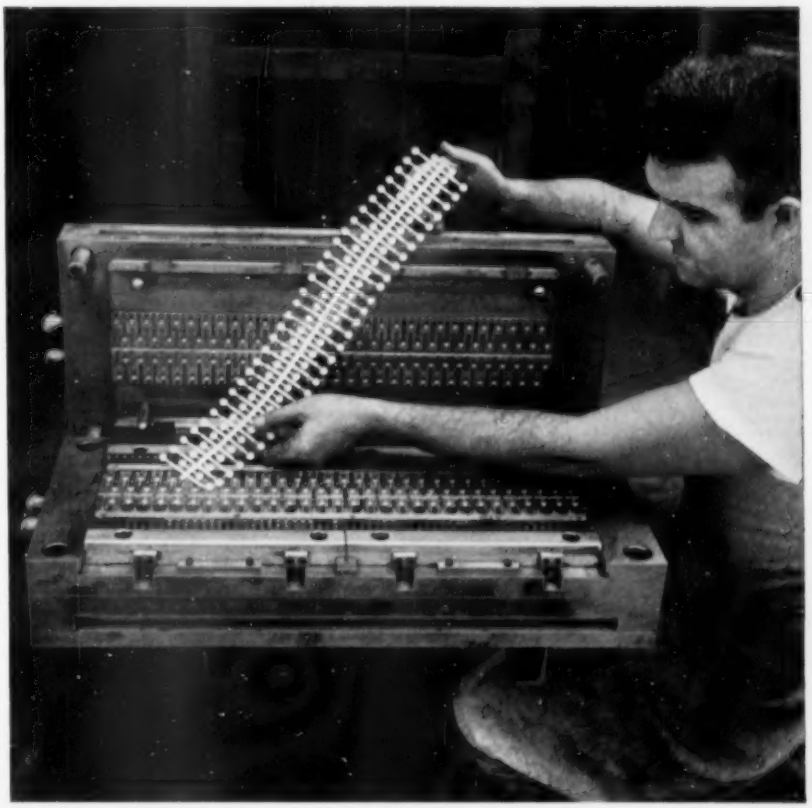
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Air-Quenching Adds to Life of Hot-work Tools

Most hot-work tool steels can be hardened by quenching in oil or air. Because of convenience in handling, and in order to avoid excessive scaling, many hot-work tools are oil-quenched. However, air-quenching is better practice because air-quenched tools have lower residual stresses than tools which have been liquid quenched. Since heat-check failures develop from surface stresses produced in service, the presence of residual stresses in the tool itself can lead to premature failure. Tools with low residual stresses are best suited for long service life on hot-work applications. That's why air-quenching is usually considered the most practical procedure for hot-work tools.

Putting the Bite in Chisel Steel

At Stanley Tool's Atha Plant, Newark, N. J., dies of Bethlehem Lehigh H tool steel are used in trip hammers of this type to forge cold chisel blades. Lehigh H, our special-purpose high-carbon, high-chromium grade, is ideal for this type of application because of its excellent wear-resistance and adequate red hardness.



INJECTION MOLD OF DURAMOLD B

Pops Out Plastic Poppit Beads

This injection mold, containing 120 cavities, is used in an 8-oz injection machine to produce one size of the popular polyethylene Poppit Beads. The mold is made of Bethlehem Duramold B tool steel, and was produced by R. A. Koegl Stamp & Die Works, Hillside, N. J., from steel supplied by Ackerlind Steel Co., Inc., New York.

Duramold B is an oil-hardening, chromium-type of plastic-molding die steel, with an addition of boron. In heat-treatment, it develops a surface hardness of Rockwell C62.

Duramold B is ideal for long service life because of its high core-strength and resistance to wear. Toolmakers are sure to like it because it can be annealed to a hardness of 100 max Brinell, which permits easy cold hobbing, even where deep or large cavities are used.

Typical Analysis

Carbon 0.07	Manganese 0.30
Silicon 0.15	Chromium 1.00
Molybdenum 0.25	Boron added

To order a trial piece of Duramold B, or obtain detailed information about this or any other grade in Bethlehem's complete family of tool steels, simply get in touch with your Bethlehem tool steel distributor.

Cincinnati Press Brake Dies

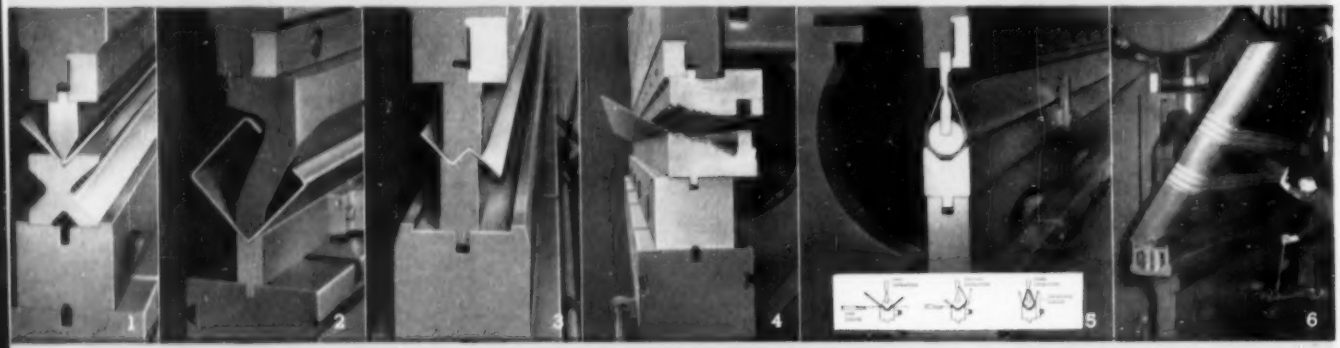
COMPLETE DIE SERVICE

The problem of selecting the proper die is constantly recurring, and many times calls for the best technical skill and accumulated experience available. The Cincinnati Shaper Company offers complete facilities for manufacturing hundreds of dies, for the forming of a variety of products. Also available are the prompt services of our Application Engineers, a department thoroughly experienced and equipped to engineer the special dies you may require.

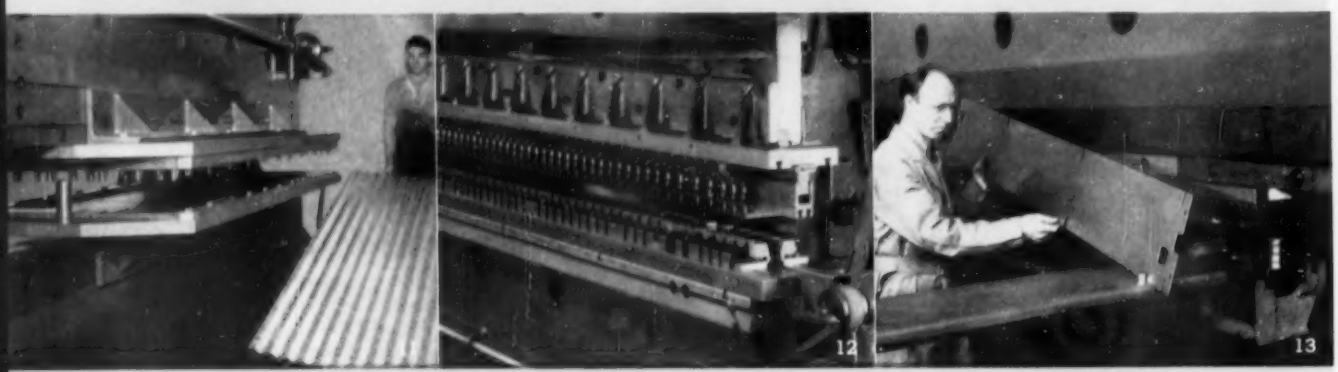
APPLICATION ENGINEERING DEPARTMENT

Our Application Engineers stand ready to give your production problems individual attention. They will aid you in the selection of proper punching equipment, if punching is your problem. A background of 30 years of widely varied experience is represented in this department, in literally every field associated with our machines.

To permit our Application Engineers to be of maximum service, as much information as possible should be given when sending us an inquiry or an order. Small details such as angles and radii on even the simple dies depends on such data. With complete information we will be able to make sound recommendations on methods



A typical 4-way die, equivalent to 4 single vee-dies, is shown in photo 1. Photos 2 and 3 show gooseneck and offset dies, respectively. A special die for producing 16 gauge molding is shown in photo 4. The closed U bend shown in photo 5 is formed in 3 hits. Photo 6 shows a large truck body panel being formed.



Tooling for punching grain bin sheets is mounted on special bolsters in photo 11. Spring plungers are used for strippers. Photo 12 shows a double row punching setup. Gags are used to give different hole groupings. Four edges of a control cabinet blank are punched and notched on the setup shown in photo 13.

THE CINCINNATI SHAPER CO.

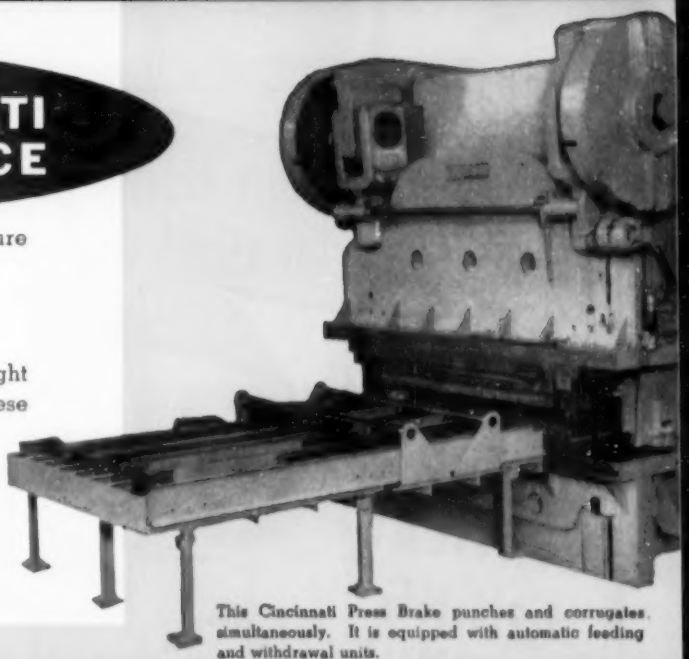
CINCINNATI 25, OHIO, U.S.A. SHAPERS · SHEARS · PRESS BRAKES

A COMPLETE CINCINNATI ENGINEERING SERVICE

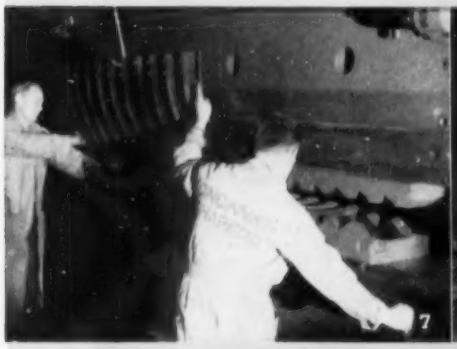
and die design, as well as an estimate of the pressure that will be required.

DIE MANUFACTURING

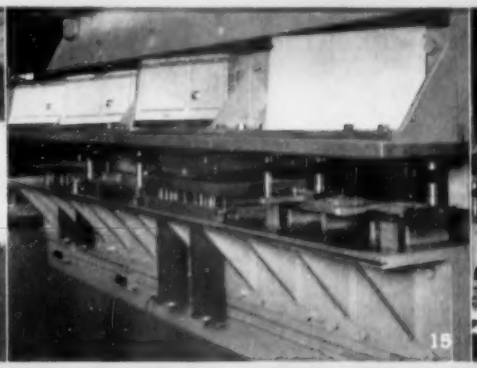
Dies cannot be classified as "standard" even for right angle bends, since there are many designs for these dies alone. Therefore, we do not stock finished dies. Instead, we carry a large stock of brake die steel. Our machining, assembling and testing facilities are ample for producing high quality, fully tested dies for any Press Brake work.

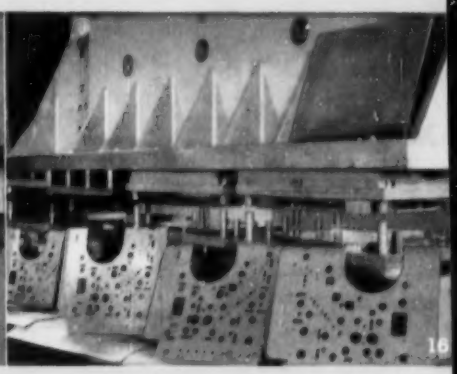


This Cincinnati Press Brake punches and corrugates simultaneously. It is equipped with automatic feeding and withdrawal units.



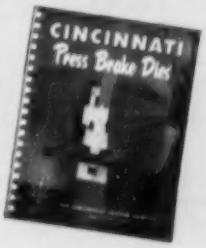
The dies shown in photo 7 form corrugated culvert sections in successive hits. Photo 8 shows conical sections being formed with standard dies. Steel roof decking is made with the "double-decker" dies shown in photo 9. The setup shown in photo 10 produces 2 miles of galvanized gutter per hour.





The progressive die setup shown in photo 14 is used for punching and drawing switchboard parts. Photo 15 shows a progressive die setup for making refrigerator top components. Pressure for draw operation is provided by rubber cylinders. Photo 16 shows a progressive die setup for producing television chassis.

The photos on these two pages show just a few samples of the Press Brake tooling and material-handling equipment designed and furnished by the Cincinnati Shaper Company. For more information, write Department E for Catalog D-2.



THE R and L TAP AND DIE HOLDER

CAN BE 6 TOOLS IN ONE!

It will be good news to many to learn that R and L has adapters for ACORN DIES and BUTTON DIES which are precision made to fit the R and L TAP AND DIE HOLDERS.

As you can see from the specifications and prices below, for a comparatively small investment an R and L TAP AND DIE HOLDER can truly become 6 tools in 1 . . . A Tap and Die Holder . . . and Acorn Die Holder . . . and a Button Die Holder . . . *For right and left hand threading!*

LEST YOU FORGET . . .

. . . The R and L TAP AND DIE HOLDER has an entirely new releasing mechanism, and can readily be changed for right or left hand threading. No spring plungers to wear or break. No small screws to work loose.

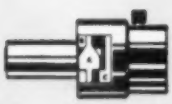


Figure 1.
Ready to start threading operation, clutch slightly engaged at C.

Figure 2.
Instantly engaged to full contact between A and C as soon as tap or die engages work.

Figure 3
Fully released showing ample clearance between contact points of clutch preventing re-engagement or hammering of clutch points in case turret advances slightly after clutch releases.

R and L TOOLS
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

OTHER FAMOUS R and L TOOLS:
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

R and L TOOLS TE-7
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☐ Please arrange for no-obligation demonstration of R and L TOOLS

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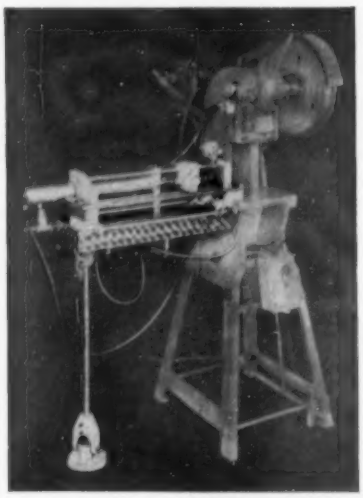
IMPROVE YOUR PRESS-ROOM PRODUCTION WITH THESE

U S PRODUCTS ★



Left: ASF-12 U. S. Air-Operated Slide Feed used in conjunction with small OBI Press. On light work requiring long pitch or feed length, this type of Feed can be used with presses much smaller than would ordinarily be required.

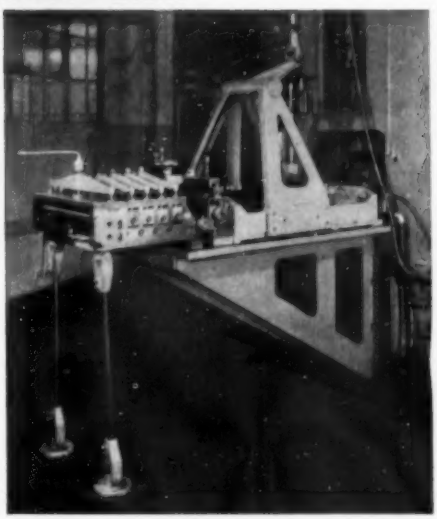
Gain all the advantages from the use of coil stock in your Press Room by arranging your presses with automatic equipment. The illustrations show just a few of the many units included in the line of U. S. Automatic Press Room Equipment designed and built to aid you to reduce costs and increase production. Every operation eliminated will increase your profit potential and place you in a more favorable position in today's competitive market.

Investigate! Ask for copies of Bulletins 80-T and 95-T.

U. S. TOOL COMPANY, INC.

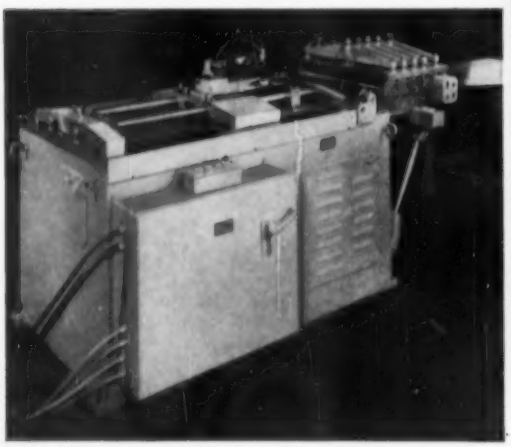
Ampere (East Orange) **New Jersey**

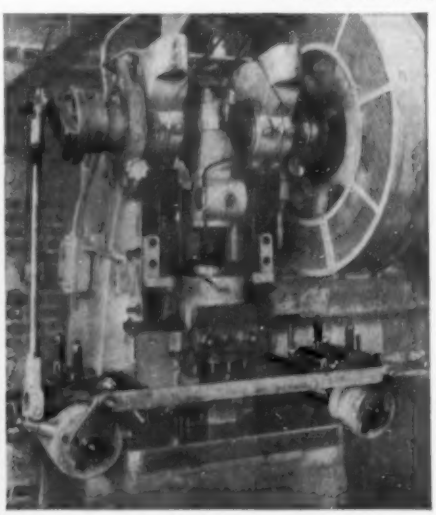
★ **U. S. PRODUCTS** — Slide Feeds — Roll Feeds — Plain and Power Driven Straighteners — Plain and Power Driven Stock Reels — Coil Cradles — Combination Cradles and Straighteners — Stock Oilers and Wipers — Scrap Choppers — Die Sets — Multi-Slides® — Multi-Millers®



Above: SF-24-24 U. S. Slide Feed equipped with Plain Straightener mounted on Straight Side Press. Capacity for material up to 24" in width, feed length adjustable up to 24" per stroke. Same type of Feed made in smaller sizes.

Below: SFC-24-24 U. S. Cabinet-Mounted Motor-Driven Slide Feed equipped with Plain Straightener. Capacity for material up to 24" in width, feed length adjustable up to 24" at one stroke. Equipped with counter to permit multiple stroking to obtain longer lengths.





Left: U. S. Double Roll Feed (push-pull type) mounted on conventional OBI Press. Direction of feed can be either right to left or left to right. Made in range of sizes.

Northwestern TOGGLE-SHOE CLAMPS

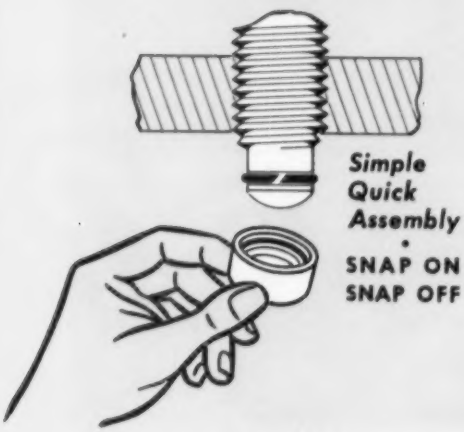
THREE NEW SOCKET TYPES! KNURLED SHAFT • KNURLED HEAD • HAND KNOB

ALL TYPES ARE INTERCHANGEABLE WITH *"SNAP ON-SNAP OFF"* ROUND OR V-PADS

PATENT APPLIED FOR

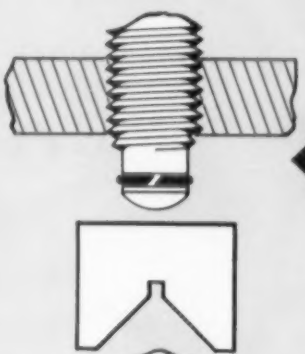
SIZES — ¼-20 to ⅜-11 **LENGTHS — 1" up to 5¼"**

There is a dealer near you that stocks Northwestern Tools — Write for information.



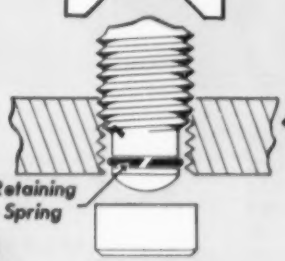
Simple Quick Assembly

• SNAP ON SNAP OFF



10° ADJUSTMENT in all directions

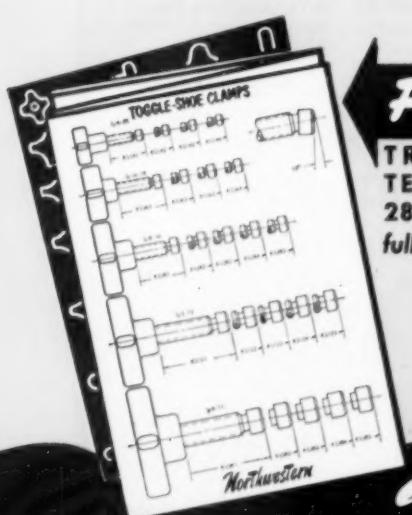
Retaining spring holds shoe in place yet allows a full 10° adjustment in all directions.



Retaining Spring

NO INTERFERENCE
Shoe only 1/16 larger than bolt

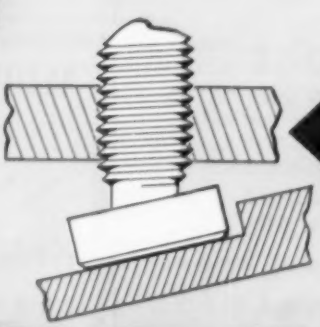
Short shoe design requires a minimum distance between fixture and the work.



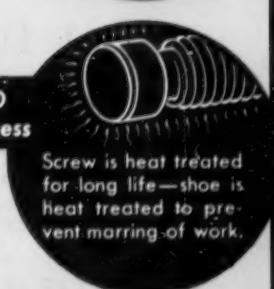
Free

TRACING TEMPLATE 286 ITEMS

full Scale • •

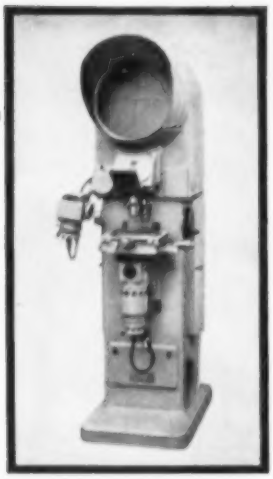


HEAT TREATED for max. toughness



Screw is heat treated for long life — shoe is heat treated to prevent marring of work.

122 HOLLIER AVE. **Northwestern** **DAYTON 3, OHIO**



NIKON OPTICAL COMPARATOR, MODEL III

NIKON OPTICAL COMPARATORS

offer greater versatility

By means of a dual illumination system (episcopic and diascopic) the Nikon Optical Comparator permits the study and measurement of surface textures as well as edge contours. A lens turret provides rapid, convenient changeover of magnifications; lenses are available at 10, 20, 31.25, 50, 62.5, 100, 120 and 230X magnifications.

and brightest illumination

A unique condenser turret permits rapid selection of condensers to match each lens magnification for optimum illumination efficiency. This feature, in combination with the fully coated Nikkor optical system, provides an exceptionally brilliant projected image, uniformly bright from edge to edge on the viewing screen.

at lower cost

A Nikon Optical Comparator is available at considerably less cost than you would expect from an instrument that offers such accuracy and versatility.

For complete details, specifications and prices on floor and table models, write to Dept. TE-7.

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Longer Life TO TAPS AND REAMERS

Taps and reamers are often discarded long before they should be because of imperfect work which, in many cases, is due to faulty set-ups rather than to wornout tools.

You can correct this situation by changing over to Ziegler Tool Holders which automatically compensate for inaccuracies in spindle alignment up to 1/32" on the radius or 1/16" on the diameter.

Try this proven way of giving longer life to taps and reamers! It will reduce your tool costs considerably!

PROMPT DELIVERY

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Ziegler ROLLER DRIVE **FLOATING HOLDER** for Taps and Reamers...

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Eliminates expensive tool construction – Reduces tool wear – Prevents seizure and pilot breakage – Especially adapted where precision is required.

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The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

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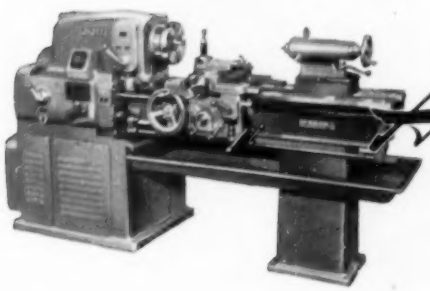
top value per dollar

with a Hendey No. 2E Lathe

timesaving controls step up efficiency of toolroom or production turning!

Because all controls were designed with the operator in mind, the Hendey No. 2-E general-purpose lathe today is setting new standards of efficiency on both toolroom and production jobs. Two outstanding features are the electronic drive that permits infinitely variable speed control, and the instantaneous dynamic brake for rapid stopping and reversing of the spindle.

Here are more Hendey "top-value" features you'll want to check further: quick-change gearbox providing 48 changes of threads without changing gears; thread-chasing dial for returning carriage to the same thread groove; quick-change gearbox for 48 changes of feed without gear change; pushbutton energizing of main motor; and *two* control levers, permitting operator to start, stop, or reverse the spindle from any working position. Contact your nearby Hendey dealer for complete details and specifications.



for precision with production, buy Hendey

Hendey **machine division**

BARBER-COLMAN COMPANY

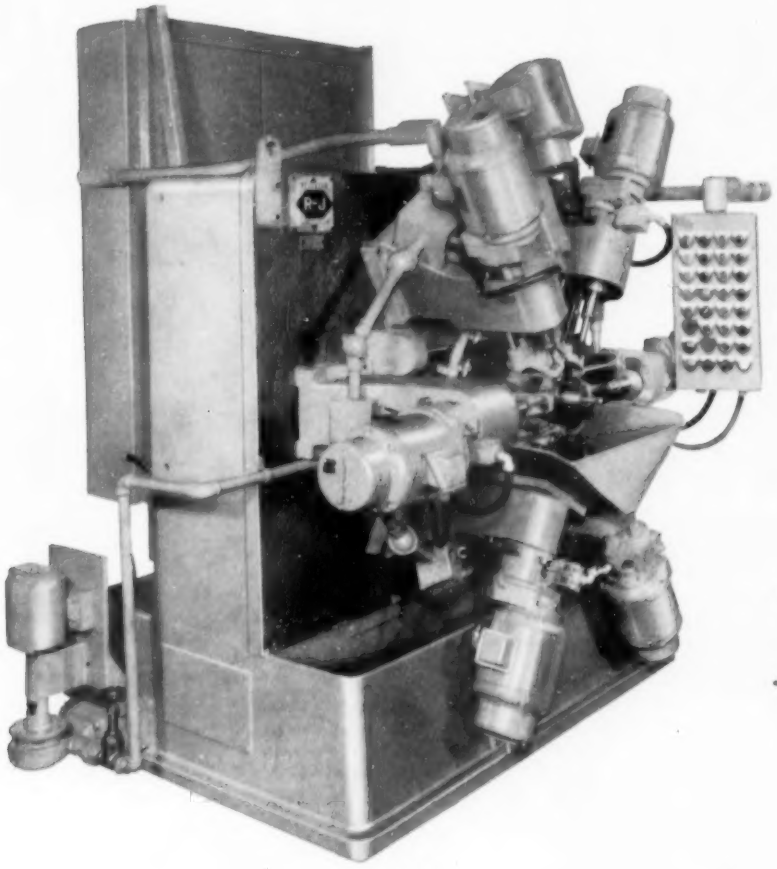
73 Loomis St., Rockford, Illinois

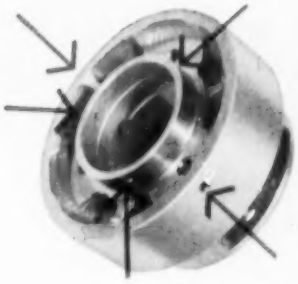
BARBER COLMAN

Standard R-J Units — one Index Unit and seven Drill Units — are mounted on a *vertical* column to make a compact production machine. The piece is part of an automatic transmission.

R-J MACHINE NO. 1244

REHNBERG-JACOBSON

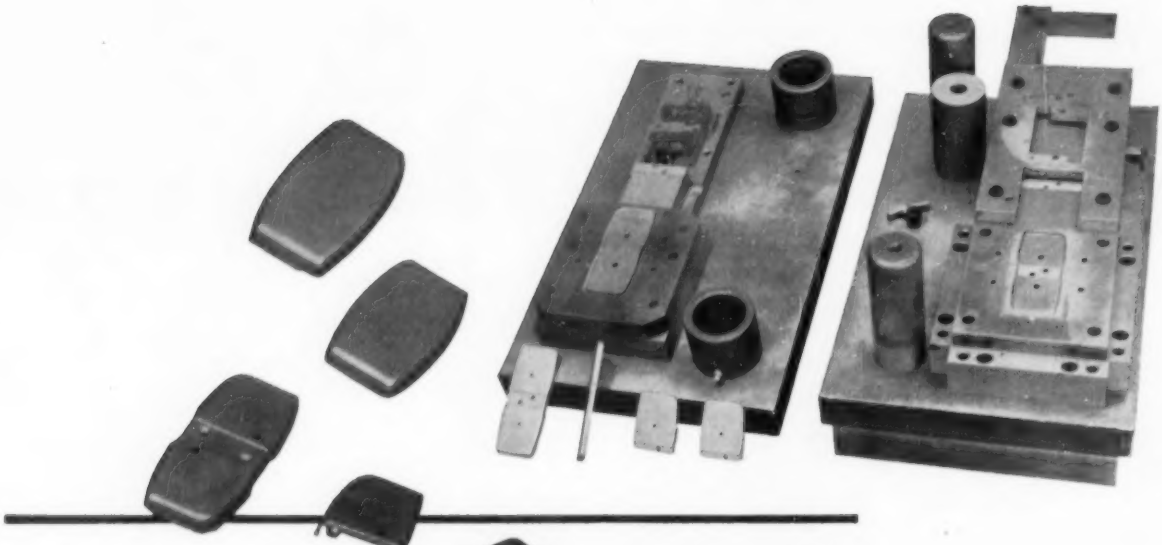




FOR FAST WORK ON A FEW HOLES

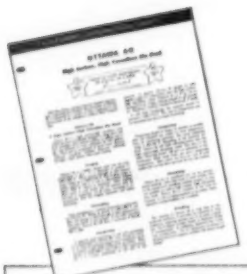
This machine is specially arranged to take care of two reamed holes in the outer rim and three angular countersunk holes in the inner rim, as indicated by the arrows on the picture of the piece. Six spindles drill, ream, and countersink the two outer holes, and a single angular spindle combination drill/countersinks the three inner holes. Note that, in order to do this, the index unit is a 3-position job, 120° each index, so the main spindles are programmed to operate only in opposite pairs on a skip sequence. The three-operation cycle is completely automatic with a full stop at the finish of each cycle for reloading. *We specialize in the rapid design and manufacture of compact, efficient, ingenious machines for many similar production operations.*

REHNBERG-JACOBSON MANUFACTURING CO.
2135 KISHWAUKEE ST., ROCKFORD, ILLINOIS
DESIGNING ENGINEERS, MANUFACTURERS,
AND PRODUCTION CONSULTANTS



These OTTAWA 60 DIES PAYOFF BIG IN 3 WAYS

- ★ Buffing Time Reduced ½
- ★ Rejects Reduced 20%
- ★ Stoning and Regrinding of Dies Reduced 75%



Write for BLUE SHEET on OTTAWA 60

This concise four-page folder gives all needed handling and shop treatment details on Ottawa 60. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. TE-91

WBW 6640

One way to increase profits is to reduce finishing costs. That's what a fabricator of hearing aid cases accomplished when he switched from regular die steel to A-L's air hardening Ottawa 60 high carbon-high vanadium grade.

Ottawa 60 dies produced stainless steel cases which were free from galling and scoring—were nearly perfect as they came out of the dies. Less than half the previous buffing time was needed to bring them to the required high finish. Rejects—which ran about 20 percent before the use of Ottawa 60—were reduced almost to the point of elimination. Also, the new Ottawa 60 dies required stoning and regrinding only a quarter as often as the standard tool steel dies they replaced.

This same manufacturer has passed along significant savings to other customers through the use of Ottawa 60. By practically eliminating rejects due to corner cracking and scoring, customers receive better stamped parts at lower per-piece cost.

Let us show how you, too, can save with A-L tool steels and, at the same time, furnish your customers a better product.

Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.

For nearest representative, consult Yellow Section of your telephone book.

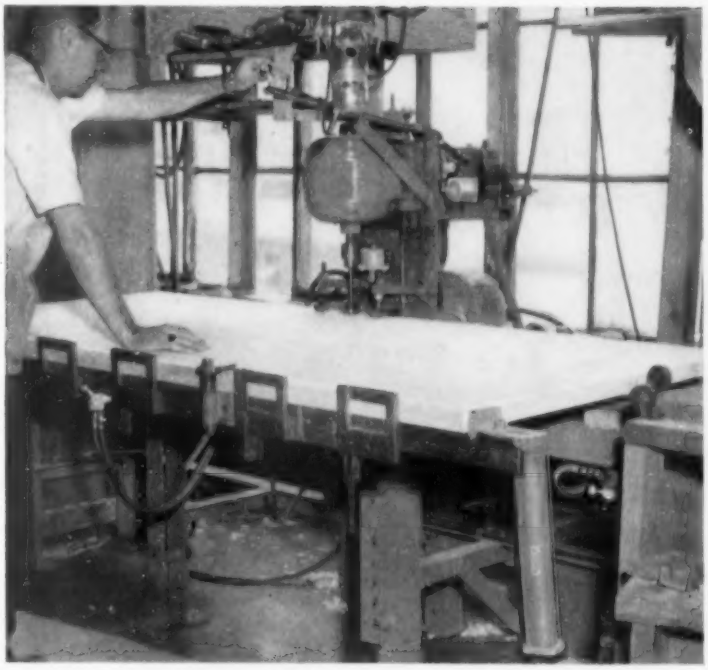
For complete **MODERN** Tooling, call

Allegheny Ludlum

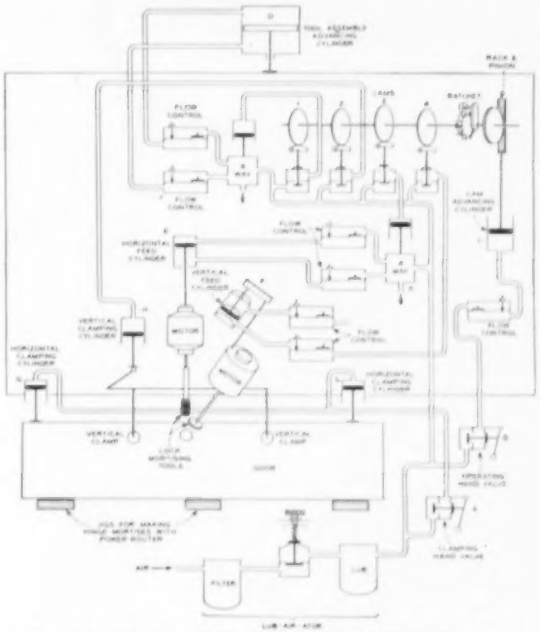
AL® FINE TOOL STEELS SINCE 1854

***Progress** in plan-it-yourself air systems:*

You can use Schrader Air Products to produce faster at a lower cost



A revolutionary building trend—pre-hung doors—means tremendous savings. Doors and frames are mortised for lock sets and hinges, assembled. This schematic shows how the door is prepared.



Air is a *natural* for many operations in processing, handling and other multi-step production . . . even to mortising doors in the woodworking field. Every day air's speed, simplicity and safety are effecting new production records.

Here's an example:

At a prominent Western woodworking company, Schrader Air Products are used on the door-mortising machine to clamp work in place, advance programming cam, and actuate all tool feeds. The machines work with extreme precision and the speed and economy of the operation are spectacular.

Chances are that Schrader Air Products can do the same for you no matter *what* you do. Take advantage of Schrader engineering facilities, available upon request, to assist you in planning for the best use of air in your production, and selection of the *right* Schrader Products to fit your needs.

Information is available by writing directly to us . . . and our Distributors are conveniently located for fast delivery.

Schrader®
a division of SCOVILL

QUALITY AIR CONTROL PRODUCTS

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Hold mill-like tolerances of ± .005" on

ANY METAL . . .

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STONE

MODEL M-100

Chop-Stroke Cut-Off Machine gives fast, accurate, fully automatic cutting

Cuts any stock . . . in a wide range of shapes, lengths and diameters . . . any material, from aluminum to hardened tool steel. The M-100 will cut it swiftly, cleanly, accurately. Set-ups or resets are easily made. The M-100 cuts at a rate of 2 to 4 seconds per sq. in. cross sectional area . . . up to 5 times faster than comparable power cutting. Exclusive Stone geared-in-head motor delivers maximum power to the cutting edge. Greater speed of cutting produces no change of characteristics nor hardening of material cut.

The M-100 is powered by a 10 H.P. continuous duty, TEFC ball bearing induction type motor. Cuts ferrous metals with an abrasive wheel . . . nonferrous metals with a saw blade. It comes with fully automatic stock feed and automatic abrasive wheel wear compensator for faster, more accurate cutting without shut-down for adjustment.

The M-100 may be had for manual or semi-automatic operation. For greater power needs, a 15 H.P. motor is available.

WRITE TODAY for complete information on the MODEL M-100, and other cut-off machines by STONE. Sales and service in principal cities.

". . . represented in every major industry throughout the world."

STONE MACHINERY COMPANY, INC.

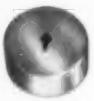
31 Fayette Street, Manlius, New York

USE READER SERVICE CARD; INDICATE A-7-264-1

Punches and Dies

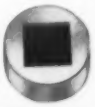
. . . for foot and power presses

Standard Punches and Dies of all sizes and shapes in stock—or made promptly to order. Also Adaptors and Die Shoes to convert your press. For power, foot or hand operation.



Round, square, rectangular, slotting, notching, louvre, angle, multiple, knock-out and other shapes. Precision made from high grade tool steel. More than 25,000 sets in stock to choose from.

Send for free illustrated catalog No. 154-AC NET PRICE SHOWN! *What are your punch and die needs?*



WARD Machinery Co. 564 West Washington **Chicago 6**

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TRUE-TRACE

MACHINE TOOL CONTROLS

Send for new 24 page catalogue

Greater production and increased profits thru 1, 2 and 3 slide control hydraulic tracers and numerical controls.

TRUE-TRACE SALES CORP.

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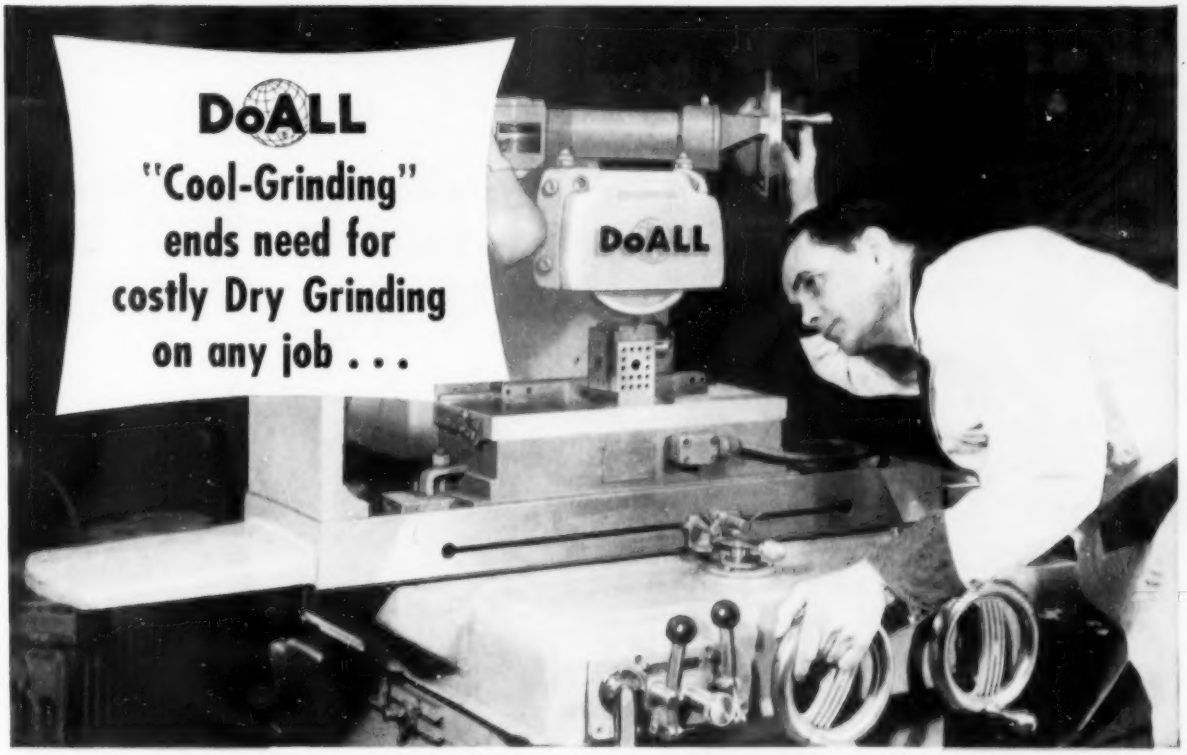


Coolant Does Not Obstruct Operator's View . . . User Ups Production 250%, Wheel Life 350%

In DoALL "Cool-Grinding", coolant is introduced into the sides of the wheel and flows out in a mist at point of cut. There is no heavy coolant stream and no coolant nozzle to obstruct the operator's view of the work. Hence, the only reason for ever employing costly dry grinding is eliminated.

Here is how Milwaukee Precision Grinding Corporation, Milwaukee, Wis., gained by switching from dry grinding to DoALL "Cool-Grinding" on the intricate and difficult job pictured:

1. Burning and warpage of work eliminated—formerly, losses were excessive.

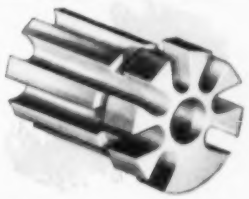
2. Finish improved—a harder, finer grit wheel can now be used.

3. Production increased 250%—they now do in two days what formerly took a week.

4. Wheel life increased 300% to 400%—costly wheel dressing taking 1½ hours now done ¼ as often and fewer wheels consumed.

Before "Cool-Grinding" was used, this job was a headache nobody wanted. Milwaukee Precision Grinding took it as a challenge . . . and found the answer.

Do you have toolroom or production line jobs you are grinding dry because the operators have to see the work?



THE JOB NOBODY WANTED—grinding the slots in this cavity die insert used in molding plastic sockets for TV tubes. ⅝ of the weight of the piece is removed by grinding. A headache with dry grinding, "Cool-Grinding" made it routine.

Then, find out about DoALL Precision Surface Grinders with the "Cool-Grinding" attachment. You can use coolant without obstructing visibility, increase your production and cut your costs.

Call your local DoALL Store or write:

The DoALL Company
Des Plaines, Illinois

"Cool-Grinding" Attachment for DoALL Precision Surface Grinders

Coolant is fed to the sides of the wheel. Centrifugal action pulls it through the wheel and out at the periphery in a fine mist. This keeps the workpiece from overheating at the point of cut where the heat is generated. Flood cooling is also provided but can be shut off when work visibility is paramount.

SEND FOR CATALOG

. . . contains complete description of "Cool-Grinding" and all models of DoALL Precision Surface Grinders.

ASK FOR FREE DEMONSTRATION AT YOUR PLANT

You can see "Cool-Grinding" in action right in your own plant on a DoALL mobile demonstration unit. Ask your DoALL demonstration specialist to call—there is no obligation.

Friendly DoALL Sales-Service Stores in 38 Cities

Cool Grinding U.S. Pat. No. 2470350

THIS IS A TYPICAL DoALL STORE

This Cadillac 6" PLA-CHEK GAGE *IS ACCURATE* to .00005"

Cadillac PLA-CHEK

For checking smaller jobs, gages, tools and dies, this portable 6" Cadillac PLA-CHEK Gage is accurate to .00005". It can easily be checked in and out of your tool crib to be used on the surface plate or at the machine. It is completely self-contained and extremely simple in operation. Speeds inspections from minutes to seconds.

Capacity of the 6" PLA-CHEK model can be increased by the addition of a 6" riser without affecting accuracy or sacrificing portability. Send coupon TODAY for complete details!

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN

Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

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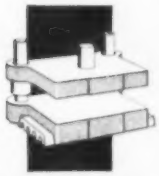

NOW all SUPERIOR die sets have

Superfinish

GUIDE PINS

HIGH LUSTRE MICROFINISH (2-5 Micro Inches)

Results in

1. **Maximum Surface Hardness**
2. **Increased Bearing Surface**
3. **Longer Pin and Bushing Life**
4. **Greatly Reduces Possibility of Scoring**
5. **SMOOoothor Action**

The process of Super Finishing removes the soft outer skin (appx. .0002-.0003) caused by the heat induced as a result of grinding.

Super Finish eliminates charging which is common to pins lapped with an abrasive compound.

Super Finishing, long a prerequisite in the Automotive and Aircraft Industry for precision bearing surfaces, is now a standard on Superior guide pins. With Super Finished guide pins ideal clearances can be maintained due to a greater bearing surface.

For Fast Local Service Call Those Superior Representatives

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another die set advancement by **SUPERIOR STEEL PRODUCTS CORP.** 2754 S. 19th ST., MILWAUKEE, WIS.

ADAMAS "GRADE A"

PERFORMANCE WINNER

For its role as the "standard of the industry" Adamas Grade A ranks as performance winner among all competing 6% cobalt straight tungsten carbide grades, (industry classification C-2).

Grade A's outstanding performance in cutting tools, dies, and wear parts has won the applause of carbide users throughout the United States and Canada. Here is a dramatic sample of Adamas Grade A throwaway inserts in action on a typical turning operation of Navy "type D" cast iron . . .

192 pieces per corner with a .250 depth of cut, 170 S.F.P.M. and .018 feed.

Even in the carbide industry, stars are made not born. Grade A's success is the result of Adamas' unique manufacturing processes which give Grade A its superior combination of three key metallurgical properties: . . . hardness . . . density . . . and transverse rupture strength.

Benefit from Grade A's metallurgical superiority . . . write today for your free copy of: "Grade A . . . Metallurgical Facts and Application Tips".

Address Dept. 251

Contact Adamas for the name of your local distributor.

ADAMAS CARBIDE CORPORATION, KENILWORTH, N. J.

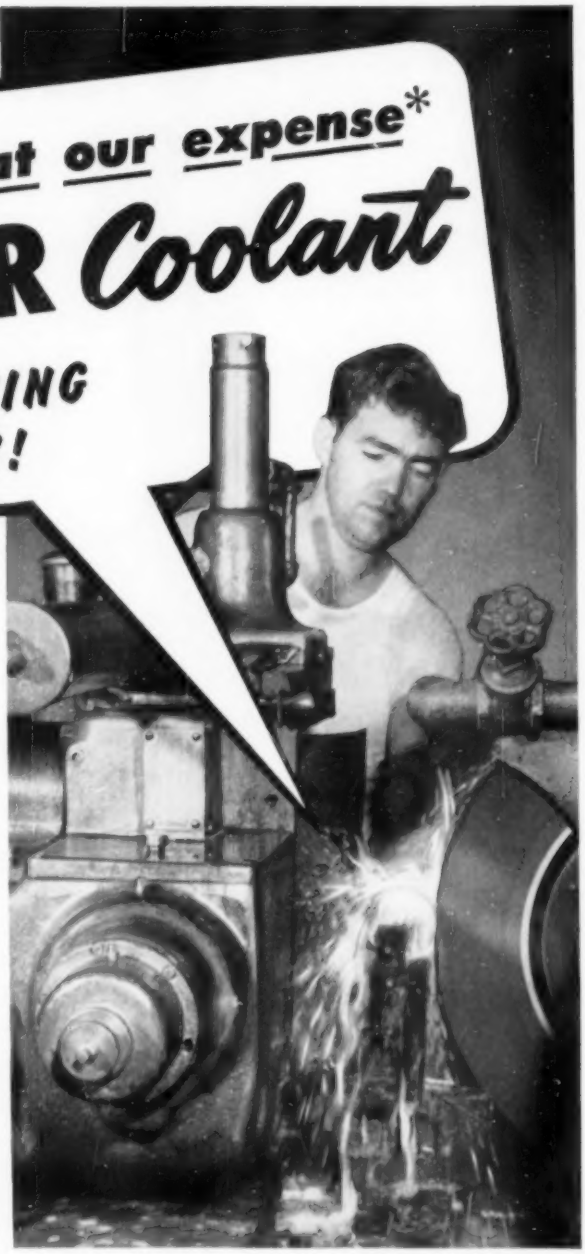
PRODUCERS OF TUNGSTEN CARBIDE TOOLS, TOOL TIPS, DIES, WEAR PARTS, DEX-A-TOOL and CERALOX.

See For Yourself at our expense*

HAMIKLEER Coolant

(REG. U.S. PAT. OFF.)

CUTS METALWORKING COSTS 6 WAYS!



Here's how HAMIKLEER—the odorless, synthetic coolant and rust preventive—can cut your metalworking costs 6 ways:

1. By eliminating the need for and cost of many different coolants. HAMIKLEER can be used for practically any cutting, grinding or aqueous phase operation on cast iron, hard and soft steels.

2. By reducing rejects—speeding production. HAMIKLEER always keeps work cool, clean and visible, allowing finer surface finishes in shorter time.

3. By preventing rust—even in hot, humid weather—eliminating costly cleaning operations. HAMIKLEER is a rust preventive as well as a coolant and it will not turn rancid.

4. By increasing tool life to make fewer replacements. HAMIKLEER has excellent lubricity and anti-weld properties.

5. By lasting longer. The amount of HAMIKLEER consumed or "carried away" is held to an economical minimum by the thin body of the solution.

6. By eliminating costly disposal problems. HAMIKLEER can be run down drains without gumming or clogging, providing oils don't get into the mixture.

A large metalworking firm standardized on HAMIKLEER after testing 30 different brands of coolants. HAMIKLEER was the only coolant that proved overall superiority ... improving lubrication, cooling, rust prevention, better finish, longer tool life and wheel life.

SEND FOR FREE SAMPLE . . . *to test on your own metalworking operations.

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Manufacturers of
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Original Products and Processes Since 1936

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Heller nucut®

LONG ANGLE LATHE FILE

gives smoothest finish ...stays sharp longer!

Look at the long 45° angle of those super-sharp precision-cut teeth. It means greater shearing action for removing metal faster and with less pressure without clogging. The long angle provides a self-cleaning action — new chips clear out the old. This special-purpose file is cut from a heavy blank for extra strength and better results on lathe work. Both edges are "safe" to protect work shoulders. It can be used to give the right finishing touch to both hard and soft metals.

You can depend on Heller Nucut Long Angle Lathe Files to speed work and cut costs. A trial is the best convincer.

SOLD *EXCLUSIVELY* THROUGH

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"YOUR OUTSIDE TOOL ROOM"

Heller *"Job Tempered"* Tools

A job-proved Heller product!

HOLLER for HELLER ...*and be* SATISFIED!

CHOOSE THE RIGHT FILE FOR THE JOB! Heller research and over a century of manufacturing experience have been responsible for many of the most practical file developments in the field today. That's why you'll find the *right* files for your jobs among the thousands of types, sizes, shapes, and cuts that make up the Heller AMERICAN PATTERN, SWISS PATTERN, VIXEN, and ROTARY FILE lines.

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MORE ON-THE-JOB HELP! Heller's Representatives . . . backed by more than 100 years' problem-solving experience . . . are best equipped to fit the right files to new designs and materials. This valuable technical service is yours for the asking . . . through your nearby Heller distributor.

HELLER TOOL CO. SINCE 1856

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AMERICAN SOCIETY of TOOL ENGINEERS

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AN INVITATION TO AUTHORS

Authors of technical papers are invited to submit them for presentation at the fall, 1958 meeting of the American Society of Tool Engineers at Los Angeles, California, September 29 through October 3. The program is sponsored by the ASTE National Program Committee.

This is an opportunity for authors to promote the growth of tool engineering knowledge and, at the same time, obtain national recognition for their contributions.

All technical papers are printed and widely distributed by the Society, giving them lasting reference value. In addition, many of the most outstanding papers are published in the Society's magazine, THE TOOL ENGINEER, generally recognized as the most authoritative magazine in its field.

The papers may deal with any field of tool engineering. ASTE membership is not required for submission of a paper. Papers will be accepted for consideration until September 15, 1957. Outlines should be sent to:

L. S. Fletcher
Program Director
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

Authors of accepted papers will be notified by November 1, 1957.

AMERICAN SOCIETY OF TOOL ENGINEERS

H E Collins

Harold E. Collins
President

Skinner power chucking equipment makes old lathes perform

Better than New!

It's easy to convert your present lathes to Skinner power—and the savings will start at once. Automatically, you'll have high-production machines that slash your over-all machining time and costs.

Take Skinner Power Chucks, for example. Gripping and releasing are done instantly by compressed air. Hand wrenching is eliminated—work goes faster, is far less tiring. Consider what this feature alone will save you on every job!

For turning between centers, famous Skinner-distributed **+GF+** Work Drivers need only an easy half-turn of the hood for fast, sure clamping. Here, too, speed means savings. Work Drivers grip out-of-round work evenly, match clamping force to cutting pressure, drive any round or smooth blanks, from 1/4" to 8 1/16".

No wonder more and more manufacturers are turning to Skinner with all their power chucking needs. Let us show you how the wide range of Skinner power chucking equipment can modernize your lathes!

Send for specifications, applications and installation instructions. Write Dept. 187.

Skinner Power Chucks and air cylinders are available in a wide range of sizes. The "Junior" power chucking unit shown here will convert most small lathes to a high-production, more economical machine. The complete unit consists of double-acting 6" cylinders, adapters, regulators, valve and 8" self-centering chuck with gripping capacity from ¼" to 6". Individual components are also available separately.

Here a manufacturer uses a **+GF+** Work Driver to replace driving dogs on a Monarch Tracing Lathe. The lathe is used to make jig borer lead screws and the part must be removed at least five times for the entire operation. Think of the savings here, when hand wrenching was eliminated!

Skinner Power Chucks and +GF+ Work Drivers are available through leading Industrial Distributors everywhere.

SKINNER CHUCKS

The Symbol of Quality

THE SKINNER CHUCK COMPANY

ESTABLISHED 1887

NEW BRITAIN, CONNECTICUT

Index of THE TOOL ENGINEER Advertisers

July 1957 Issue

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in 1956 ASTE Industrial Exposition

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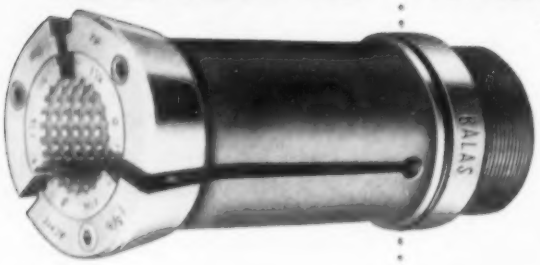
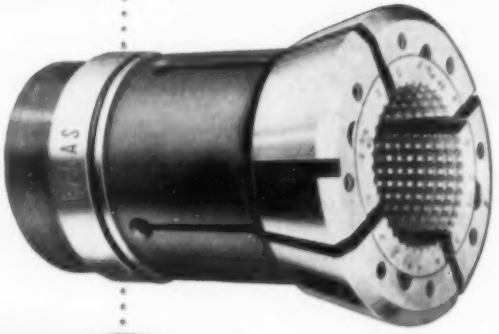
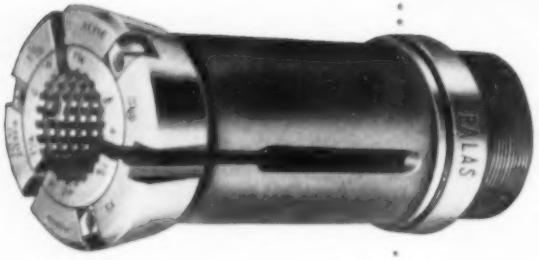


Balas "CB" Collet



Balas "CT" Collet



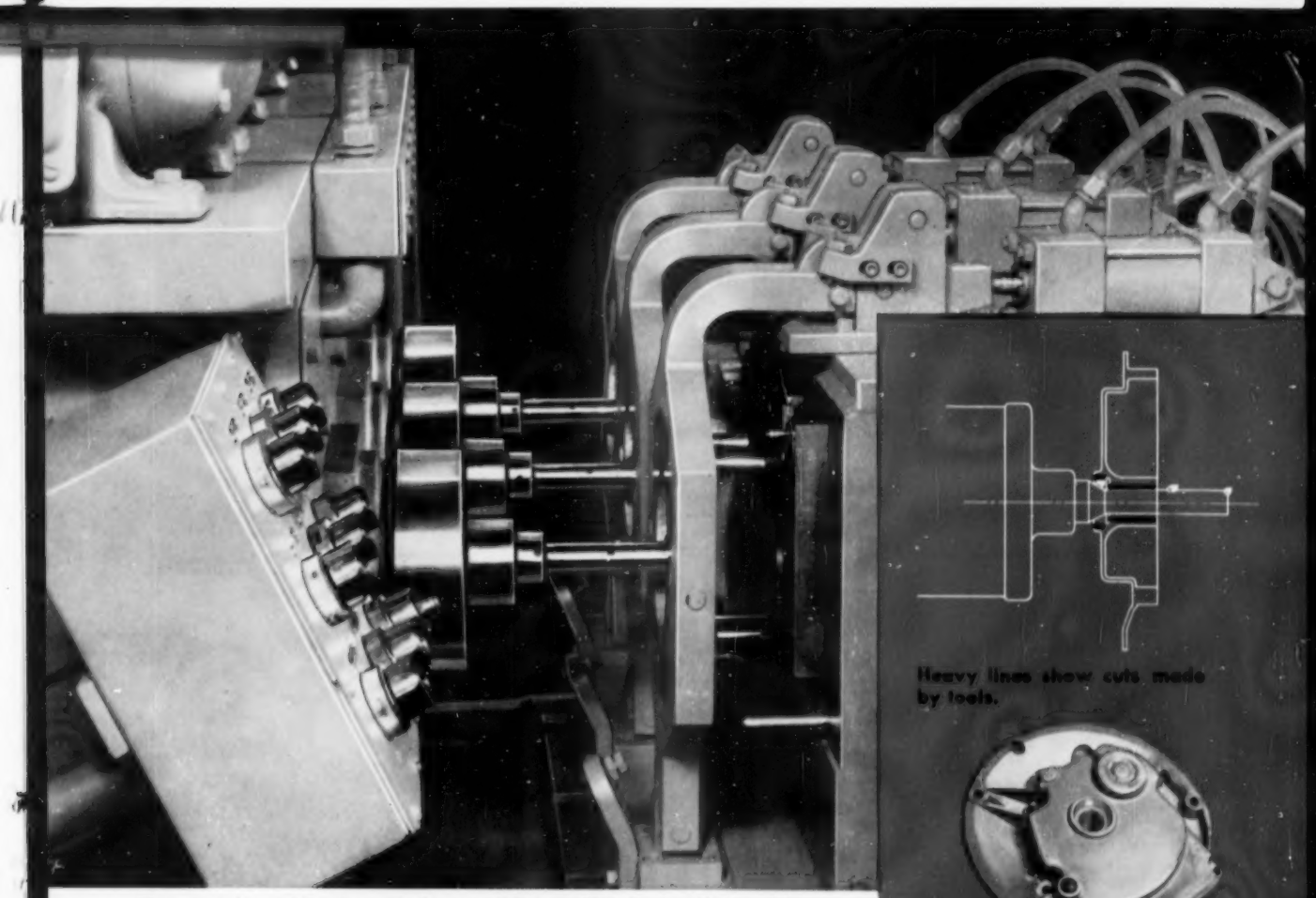
Martin Master Collet

You can avoid "down time" by using Balas Collets with neoprene "O" Ring Seals. Experience proves that machines will run many months without withdrawing the collet tubes for cleaning when they are equipped with Balas "O" Ring Seal Collets...and best of all there's no extra charge for this extra feature!

Buy Balas Master Collets and assorted sets of collet pads so you can make full use of your machines. You save money because a set of pads is only about a third of the cost of a solid collet and "change over" time is shortened by hours.

Balas Solid and Master Collets are stocked in most sizes for all popular makes of automatics. With all their extra advantages they cost no more than ordinary collets! Save valuable time, material and money by standardizing on Balas for all your machines!

BALAS COLLET MANUFACTURING CO. / Cleveland 14, Ohio



Close-up view of the three-station work fixture. Note hydraulic clamping arrangement.

Heavy lines show cuts made by tools.

Aluminum mounting flanges automatically bored on this Ex-Cell-O Boring Machine.

Full view of standard Ex-Cell-O Style 112-D Precision Boring Machine, built for extra production.

3 Parts Every 36 Seconds

A large manufacturer of appliance components slashed production costs with a standard Ex-Cell-O Boring Machine. The machine rough and finish bores and counterbores the central holes in aluminum mounting flanges at the rate of *3 parts every 36 seconds!* That's 5 parts per minute!

The machine that performs this operation is the Ex-Cell-O Style 112-D, a hydraulically-operated single-end boring machine. Rugged and versatile, this machine uses one or more spindles for rotation of either the part or tools for accurate boring of a wide variety of medium and large-size parts. With the right tooling, this standard machine can handle both large and small production runs, or can be adapted to a completely automated installation!

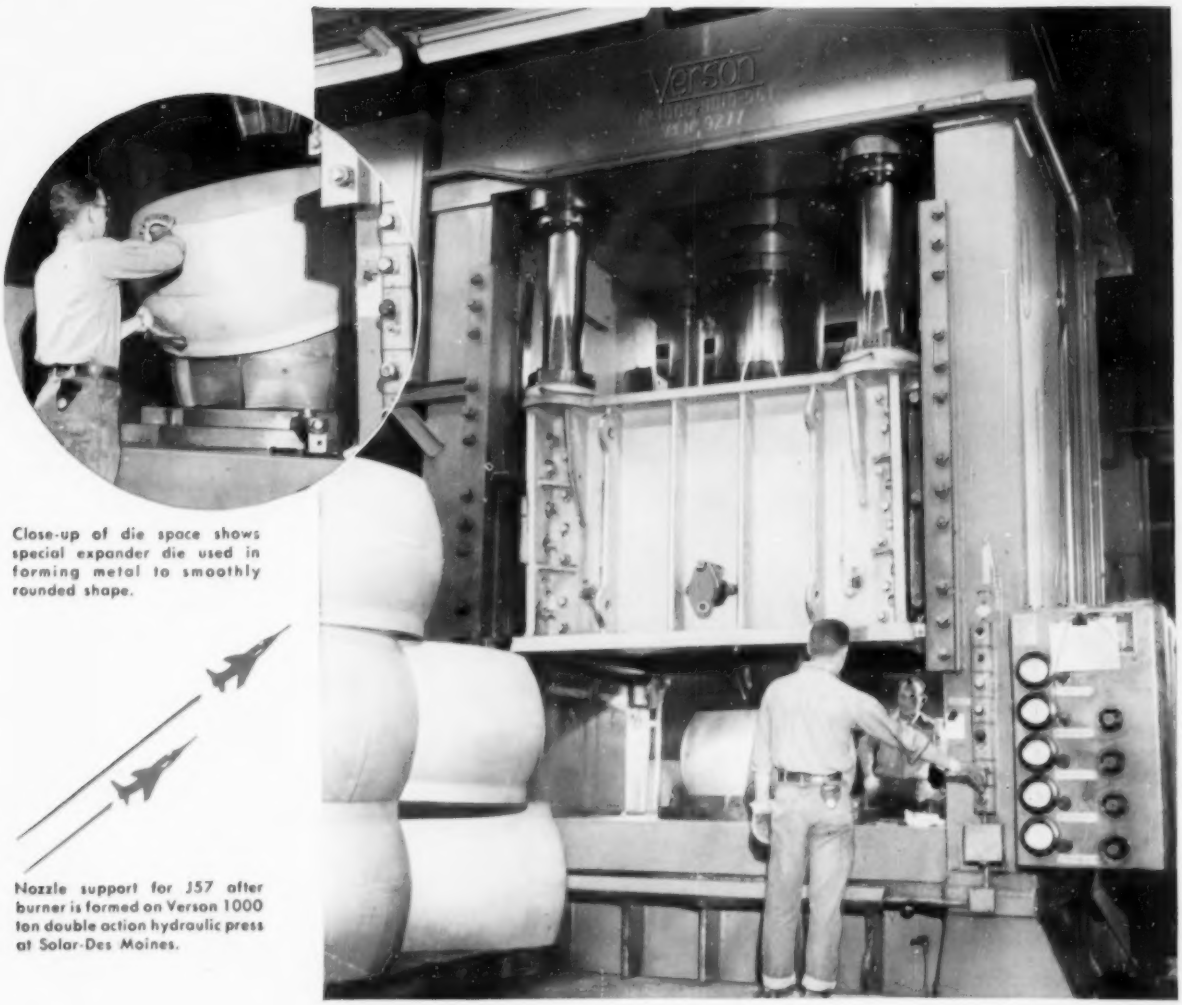
This type of machine can make a big difference in your production figures. To find out *how much* difference get a quotation from your Ex-Cell-O representative.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

XLO EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

87-19



Close-up of die space shows special expander die used in forming metal to smoothly rounded shape.

Nozzle support for J57 after burner is formed on Verson 1000 ton double action hydraulic press at Solar-Des Moines.

Another "Verson" Press proves its versatility

. . . forming jet engine components at Solar Aircraft Company

This is Verson versatility at work . . . a 1000 ton Verson double action hydraulic press . . . "workhorse" at Solar Aircraft Company's Des Moines plant.

Solar produces components for jet and turbo-jet engines which power a number of our best known aircraft. They are also engaged in the manufacture of components for guided missiles. To this end, a variety of tasks are assigned to this Verson Press, including heavy duty expanding, sheet metal embossing and deep drawing. Forming is done primarily with 300 series or 410 stainless steels, ranging in thickness from .031 to .093.

The double action press, largest of its type at Solar-Des Moines, has proved a rugged and versatile production tool. In addition to the heavy jobs, it handles general production when needed.

Big job . . . small job . . . there's a Verson press for you. For specific recommendations send an outline of your requirements.

A Verson Press for every job from 60 tons up.

"Verson" mark

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